



ARL-SR-0506 • JUNE 2025



Artificial Intelligence for Soldiers 2025: Enhancing AI Readiness for the U.S. Army

by Mark A. Tschopp, Reginald L. Hobbs, and Matthew Work

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REPORT DOCUMENTATION PAGE

1. REPORT DATE		2. REPORT TYPE		3. DATES COVERED	
June 2025		Special Report		START DATE 01/01/2025	END DATE 5/31/2025
4. TITLE AND SUBTITLE Artificial Intelligence for Soldiers 2025: Enhancing AI Readiness for the U.S. Army					
5a. CONTRACT NUMBER		5b. GRANT NUMBER		5c. PROGRAM ELEMENT NUMBER	
5d. PROJECT NUMBER		5e. TASK NUMBER		5f. WORK UNIT NUMBER	
6. AUTHOR(S) Mark A. Tschopp, Reginald L. Hobbs, and Matthew Work					
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) DEVCOM Army Research Laboratory ATTN: FCDD-RLA-I 2800 Powder Mill Rd, Adelphi, MD 20783				8. PERFORMING ORGANIZATION REPORT NUMBER ARL-SR-0506	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSOR/MONITOR'S ACRONYM(S)		11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT DISTRIBUTION STATEMENT A. Approved for public release: distribution unlimited.					
13. SUPPLEMENTARY NOTES ORCID IDs: Mark A. Tschopp, 0000-0001-8471-5035; email: mark.a.tschopp.civ@army.mil .					
14. ABSTRACT This report summarizes the second iteration of the “Artificial Intelligence for Soldiers” course, conducted by ARL in April 2025. Building on the success of the inaugural 2024 course, this year’s program was condensed to 1 week while retaining a strong emphasis on equipping Soldiers with practical artificial intelligence (AI) and machine learning (ML) knowledge and skills. The report highlights key content areas, participant ranks, and most importantly, feedback received. Notable adjustments made based on the previous year’s recommendations include streamlining AI/ML fundamentals, emphasizing capstone projects, inviting senior leaders to speak everyday, and various logistics changes. Overall, the 2025 course received positive feedback, with participants reporting increased AI/ML understanding and relevance to future military operations. The report concludes with insights for continuous improvement, aiming to further enhance the course’s impact in cultivating a more AI-ready Army.					
15. SUBJECT TERMS artificial intelligence, machine learning, natural language processing, robotics, large language models, Military Information Sciences, Science of Intelligent Systems					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	
a. REPORT UNCLASSIFIED	b. ABSTRACT UNCLASSIFIED	c. THIS PAGE UNCLASSIFIED	UU	81	
19a. NAME OF RESPONSIBLE PERSON Mark A Tschopp				19b. PHONE NUMBER (Include area code) 301-938-5389	

STANDARD FORM 298 (REV. 5/2020)

Prescribed by ANSI Std. Z39.18

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Executive Summary

On 7–11 April 2025, U.S. Army Combat Capabilities Development Command Army Research Laboratory conducted a 1-week resident “AI for Soldiers” course at the Adelphi Laboratory Center. Led by the authors (Drs. Mark Tschopp and Reginald Hobbs), the course aimed to expose Soldiers to fundamental artificial intelligence and machine learning concepts relevant to the U.S. Army, attracting mid-career staff officers, senior noncommissioned officers, and warrant officers from various specialties across the Army. In collaboration with the Futures and Concepts Center (FCC, MAJ Matt Work), they connected concepts to Army relevance. This was combined with cutting edge Army AI laboratory demonstrations in ground/aerial robotics, natural language processing, and mixed reality. The course featured invited keynote speakers including Director, Strategy, Plans and Policy from the Office of the Deputy Chief of Staff, G-3/5/7, Director of Concepts for FCC, and Director of DEVCOM Army Research Laboratory, among other senior leaders. The 28 Army participants (25 Soldiers and 3 civilians from 19 unique locations) selected by Headquarters, Department of the Army (HQDA) demonstrated a high level of engagement and concluded the week with capstone project presentations about innovative approaches to leveraging AI in military contexts. This course directly supports the Army’s goal of becoming a more data-centric organization and educating future leaders on how AI can affect the Army of the future. ARL plans to continue to partner with FCC to offer the course to future cohorts of staff officers through the HQDA Strategic Broadening Seminar program.

Feedback from the course survey indicated overwhelmingly positive responses, with 100% of participants agreeing that the course was excellent, the instructors were excellent, and that they would highly recommend this course to others.

One participant reflected on the experience:

The 1-week AI/ML course was exceptionally well-organized. The curriculum provided an excellent overview of fundamental concepts and practical applications in artificial intelligence and machine learning. Overall, it was a valuable and insightful experience that significantly enhanced my understanding of the subject matter.

This summary highlights the course’s development, feedback received, and proposed next steps for enhancing future offerings.

1. Introduction

In the future, the integration of AI into military operations will be crucial for maintaining a strategic advantage on the battlefield. Soldiers need to understand how AI works to effectively leverage its capabilities in analyzing vast amounts of data, automating routine tasks, and enhancing decision-making processes. By comprehending AI's underlying mechanisms and potential applications, Soldiers can identify innovative ways to apply AI technologies to various military domains, such as intelligence analysis, logistics, and autonomous systems. This knowledge will enable them to harness AI's full potential, ensuring that they can adapt to rapidly changing operational environments and make informed decisions that enhance mission success and operational effectiveness.

The *AI for Soldiers* course, part of the Headquarters, Department of the Army (HQDA) Strategic Broadening Seminar series, is designed for mid-career Army Soldiers seeking to enhance their understanding of AI and ML. This course is delivered by the U.S. Army Combat Capabilities Development Command Army Research Laboratory due to our knowledge and research in AI and by the Futures and Concepts Center (FCC) due to their knowledge of AI concepts in the future operating environment, allowing participants to gain insights into the Army's ongoing AI initiatives. The course aims to provide participants with intermediate knowledge of various AI/ML algorithms, their applications, and limitations, as well as a basic understanding of neural networks. By covering both the fundamentals and practical applications of AI, the course equips Soldiers with the skills needed to effectively utilize AI technologies in military contexts, fostering innovation and strategic decision-making. This comprehensive understanding of AI will enable Soldiers to identify and implement AI-driven solutions, enhancing their operational effectiveness and contributing to the Army's overall mission success.

2. Course Development Process

The development process for the 1-week course started with the 2-week inaugural course curriculum. Similar to the first course, the week was divided into 2 segments: one segment delving into the fundamentals of AI (Monday, Tuesday, and part of Wednesday / Thursday), and the other segment exploring its practical applications (Wednesday and Thursday). Day 1 introduced artificial intelligence, Day 2 focused on machine learning algorithms, Day 3 covered reinforcement learning and

robotics, Day 4 introduced natural language processing, and Day 5 concluded the course with capstone project presentations and a graduation ceremony. Days 3 and 4 also featured “AI in Action,” with laboratory visits to witness AI research first-hand and engage with scientists conducting research in AI-related domains. Each day also featured presentations by senior leaders who shared their perspectives on the evolving operational environment and emphasized the critical role of AI in both current and future Army missions. For a detailed breakdown of the course schedule, see Appendix A.

This course included 28 participants—Soldiers and civilians—selected to broaden their understanding of artificial intelligence and machine learning. Figure 1 displays a sunburst plot summarizing the ranks and grades of participants. The inner ring of the plot shows the broad categories: Officer (O, 18 participants), Noncommissioned Officer (NCO, 3), Warrant Officer (WO, 4), and Civilian (CIV, 3). The outer ring presents their specific grades, representing a range from mid-career to senior-level

Participant Rank and Grade

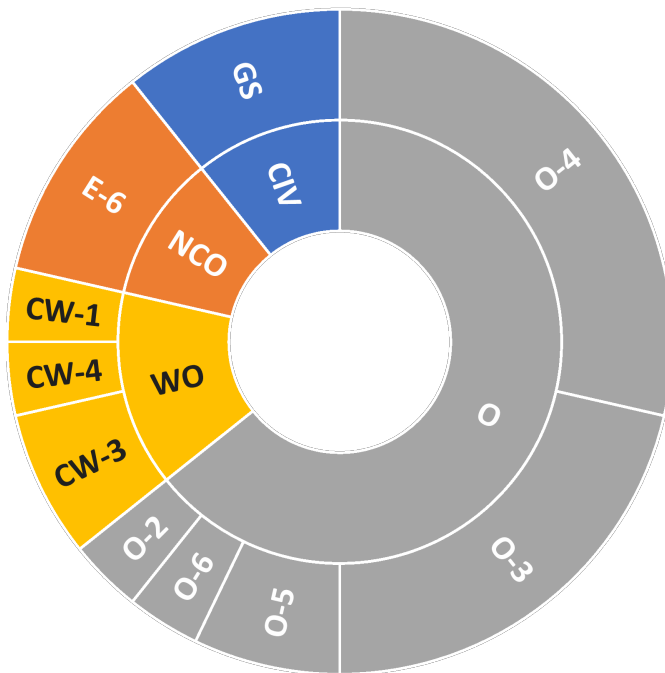


Figure 1. Sunburst plot illustrating the composition of course participants by rank and grade. The inner ring categorizes participants as Officers (O), Noncommissioned Officers (NCO), Warrant Officers (WO), and Civilians (CIV), while the outer ring displays their respective grades, reflecting a range from mid-career to senior levels.

professionals.

The *AI for Soldiers* course is organized into comprehensive modules that progressively build participants' understanding of AI and its military applications. It begins with an introduction to artificial intelligence, covering its history, core concepts, and the nature of intelligent agents. Participants then explore knowledge and reasoning, including logical agents, knowledge representation, and automated decision-making. The course continues with foundational machine learning topics—such as, key algorithms, data-centric approaches, regression, classification, and optimization—before advancing to neural networks. These sessions cover network architecture, deep learning principles, and applied examples. More advanced modules introduce architectures for image processing, compression, generative AI, autoencoders, and generative adversarial networks, with an emphasis on real-world use cases and associated challenges. The course also addresses natural language processing (NLP), including information extraction, question answering, and conversational agents. Finally, the integration of AI with robotics is examined through topics like behavior-based robotics, human–robot interaction, and autonomous systems tailored to Army needs. This structured curriculum equips participants with the technical grounding and operational awareness necessary to apply AI effectively in military contexts (see Appendix B for the detailed informational packet).

Throughout the *AI for Soldiers* course, participants engaged with distinguished speakers, researchers, and military leaders, each contributing valuable insights into AI's evolving role in defense. Appendix C provides a visual journey through the course, featuring keynote presentations by COL Michael Wagner, Dr. Scott Schoenfeld, Dr. John Fossaceca, and Mr. Dietrich Wiegmann, as they shared perspectives on AI-driven innovation. The hands-on demonstrations at Graces Quarters R2C2 on Day 3 showcased autonomous ground vehicle maneuvers and Generative AI integration with robotic platforms, while Day 4 featured laboratory visits where participants explored mixed reality applications and AI research. These images provide a visual narrative of the course's structure, key learning moments, and significant milestones—including capstone presentations, MG Stephanie Ahern's insights on AI in military strategy, and the graduation ceremony, where participants received their challenge coin and certificate of completion from Dr. Patrick Baker (see Appendix D for an example of the certificate).

3. Course Feedback

The feedback from participants in the course was overwhelmingly positive, emphasizing both the value of the material and the impact of the experience. Several comments stood out, capturing the enthusiasm and appreciation expressed by many attendees:

The 1-week AI/ML course was exceptionally well-organized. The curriculum provided an excellent overview of fundamental concepts and practical applications in artificial intelligence and machine learning. Overall, it was a valuable and insightful experience that significantly enhanced my understanding of the subject matter.

Great course! Highly recommend for ALL ranks, grades, and Military Occupational Specialty.

The instructors were fantastic. They brought interest into every concept and found a way to bring us back to the “so what” of how learning the algorithms and math and concepts would better assist us in using AI/ML. I also enjoyed the guest speakers and field trips to Graces Quarters and the labs. I thought it was a good mix of classroom time and seeing the real products.

3.1 Quantitative Course Feedback

Participants were asked to provide anonymous course feedback through a combination of quantitative and qualitative responses. The quantitative portion used a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) across several statements, while the qualitative portion asked: “What did you think of the course? Anything else you wish to add?” A screenshot of the full survey is included in Appendix E as well as the full comments in Appendix F.

The survey began by asking participants to rate their familiarity with AI prior to the course. It then presented 10 evaluation statements addressing course content, instructional quality, and participants’ confidence in applying AI. The breakdown of responses for these statements is shown in Figure 2.

Overall, the feedback was overwhelmingly positive, reinforcing the course’s value and impact. To elicit thoughtful and honest responses, the evaluation statements employed strong and unambiguous language. For example, we used terms like “excellent” rather than “good” to better capture distinctions in participant sentiment. This deliberate phrasing provided more meaningful insights into the areas where the course excelled or could be improved.

Among all evaluation statements, the most frequent “Strongly Agree” responses were for: “I highly recommend this course to others” and “The overall evaluation of the instructors was excellent.” These responses reflect not only a strong endorsement of the course but also that participants valued the way the material was presented and explained.

AI for Soldiers Course Feedback

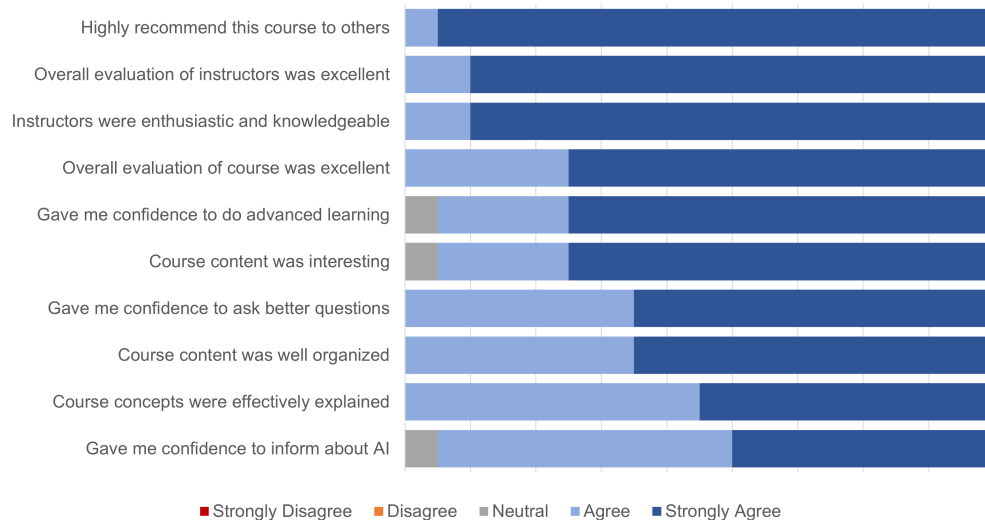


Figure 2. Anonymous participant ratings for the 2025 *AI for Soldiers* course. Respondents rated their agreement with 10 paraphrased evaluation statements on a scale from 1 (Strongly Disagree) to 5 (Strongly Agree). The horizontal bar chart displays the average rating for each statement, capturing feedback on course content, instructional quality, and overall experience.

The following percentages represent the course participants who either agreed or strongly agreed with the corresponding statements:

- (100%) My overall evaluation of the course is excellent.
- (100%) My overall evaluation of the instructors is excellent.
- (100%) I would highly recommend this course to others.

- (100%) The instructors were enthusiastic and knowledgeable about the course material.
- (100%) The presentations and course materials explained the course concepts effectively.
- (100%) The presentations and course materials were well organized.
- (100%) The course gave me confidence to ask better questions about AI and AI systems.
- (95%) The course gave me confidence to inform others about what AI systems can and can't do.
- (95%) The course gave me confidence to do more advanced learning (or understand more advanced concepts) in the area.
- (95%) The presentations and course materials were interesting.

What did you think of the course? Anything else that you wish to add?

For this question, the comments reflect that participants both learned about AI and enjoyed the instructors and course structure. Some comments also provided suggestions for improvement. Here are excerpts from the positive comments:

Overall Course Experience:

- “I loved it! I wish it was 2 weeks.”
- “The 1-week AI/ML course was exceptionally well-organized. The curriculum provided an excellent overview of fundamental concepts and practical applications.”
- “Thank you! The course was excellent.”
- “Great course! Highly recommend for ALL ranks, grades, and Military Occupational Specialty.”
- “The course was informative, and I would highly recommend others to take it.”
- “It was really great, and I already have many at my unit who are interested in attending the next one.”
- “The course was very informative. It gave me a better understanding of how AI works and how to approach AI systems in the future.”

- “Thank you for providing such an in-depth exposure to AI/ML. I’ve never seen a course like this in the Army.”
- “The course was very interesting. The material was easy to digest even with no background on coding and AI.”
- “The course was very informative and helped me understand what AI does and how it ‘learns.’”
- “One week was sufficient for my learning, and I feel comfortable explaining what I learned to my unit.”
- “Already thinking of ways to experiment here at the Training and Doctrine Command and work with the data team to see what is feasible.”

Instructors:

- “Keep Reggie and Mark teaching!”
- “Dr. Reginald Hobbs and Dr. Mark Tschopp delivered the content in a clear, digestible manner that made science and math approachable without being overwhelming. Their delivery greatly contributed to the effectiveness of the course.”
- “The instructors were fantastic. They brought interest into every concept and found a way to bring us back to the ‘so what’ of how learning the algorithms and math and concepts would better assist us in using AI/ML.”
- “I loved how enthusiastic the instructors were and appreciated their patience with my questions and lack of knowledge. This course motivated me to increase my competency in this field.”
- “The instructors were very knowledgeable and passionate about AI technology.”
- “The instructors brought interest into every concept and tied everything back to how learning the algorithms and concepts would help us use AI/ML.”

Course Content and Structure:

- “A very enlightening course that helped us build foundational knowledge about AI.”

- “This course was able to form my understanding of AI/ML at the foundational level. Having the ability to briefly understand the models and functions will help me justify required capabilities or concepts for its future use.”
- “I found the subject matter fascinating and feel I’ve inched closer to understanding how various AI models function.”

Special Mentions:

- “Special thanks to MG Ahern—your leadership presence was truly invaluable. Kudos to the ARL team for seamless coordination.”
- “A key highlight was visiting ARL and engaging directly with the scientists.”
- “I enjoyed meeting the ARL scientists and having exposure to up-and-coming Army technology using AI/ML.”
- “I enjoyed the guest speakers and field trips to Graces Quarters and the ARL laboratories. It was a good mix of classroom time and seeing the real products.”

The following excerpts provide suggestions for how the course might be improved:

Course Duration and Structure:

- ***Scale it:***
 - “I highly recommend that we implement a smaller-scale course at the Army school houses for our young leaders, who can take this information to their squads/platoons/companies and get real feedback on implementing tools or new uses for the tools. I think it would also inspire knowledge and excitement that we are investing in these leaders with emerging technology, that usually only is given to select units.”
- ***More time:***
 - “I wish it was 2 weeks.”
 - “More time at Graces Quarters to see robotics in action on the terrain would be awesome.”
 - “Acknowledging the budget restrictions, this course should certainly be 2 weeks.”

- ***Slow down the course pace:***

- “With no experience using AI tools, I found some content hard to follow at the pace it was presented. We were sprinting through slides without ample time to digest the material.”

Networking and Community:

- ***Create alumni network:***

- “I recommend establishing an AI/ML Student Alumni network—like ‘S1NET’—where ARL leaders can connect with military, DoD civilian, and contractor personnel across the enterprise. Such a platform would enable the force to disseminate more efficient information, tools, and resources.”

Course Content and Delivery:

- ***More frequent breaks:***

- “There is a lot of in-depth information—include at least 5-min breaks every hour.”
- “More breaks in between sessions—2 h of lecture is a bit much without a break.”

- ***Less math:***

- “The modules in the first 2 days seemed heavy, and I was initially thinking the deep dive into math could have skipped. I thought all I needed was an appreciation of the concepts behind AI. I appreciate the math review now and I am glad we got it. I recommend better explaining, up front, why this information is important.”

- ***Explain the ‘so what’:***

- “We dove into modules with no context. MAJ Work provided some ‘so what.’ Scene setting prior to introducing the modules would help the class understand why we’re starting with such fundamental concepts and why that information is important.”

Practical Applications and Exercises:

- ***Need practical exercises during the course:***

- “The course can be better with some practical exercises or small homework each day.”
- “Add small practical exercises to the course. It would be nice to have optional practical exercises under 1 h but adding an opportunity for feedback from an instructor the next day.”

- ***Need practical use cases for after the course:***

- “Provide examples of how service members can benefit from AI in their daily positions, i.e., for each warfighting function, how can AI help them.”
- “Share best practices of applied technique on a portal.”

- ***More hands-on AI applications:***

- “More ‘hands-on’ experience and exploration of tools like ChatGPT and DeepSeek would be helpful.”
- “Allowing personal computers on the network would help us use available tools.”

Additional Resources and Collaboration:

- ***Optional pre-/post-work:***

- “Provide online resources for introductory AI classes.”

- ***Include other Army agencies:***

- “Collaborate with the Army Applications Laboratory to show how basic research manifests into applied research!”

To distill the range of perspectives into actionable themes, Table 1 summarizes common suggestions across categories. While the detailed quotes provide context, this summary identifies recurring areas of interest—including deeper engagement, broader access, and sustained community-building. These themes can help inform refinements to the course structure and its long-term value.

Table 1. Summary of participant comments by theme

Theme	Summary of comments
Overall Course Experience	Participants found the course highly informative, engaging, and worthwhile; many said it deepened their understanding of AI and some wanted a longer course.
Instructors	Instructors were praised for clarity, enthusiasm, and making technical material approachable; they effectively connected concepts to practical relevance.
Course Content & Structure	Participants appreciated the foundational knowledge provided; content was seen as well-organized and digestible, even for those without technical backgrounds.
Special Mentions	Positive remarks highlighted ARL scientists, guest speakers, field visits, and senior leader involvement as valuable and inspiring components.
Course Duration & Structure	Suggestions included extending the course to 2 weeks, slowing the pace, and scaling versions to schoolhouses for younger leaders.
Networking & Community	One recommendation was to build a continuing alumni network to foster knowledge sharing and community across the enterprise.
Course Content & Delivery	Suggestions included more frequent breaks, reducing the math intensity (or better contextualizing it), and improving the “so what” framing of modules.
Practical Applications & Exercises	Participants wanted hands-on exercises during the course, practical AI use cases for their roles, and more interaction with AI tools like ChatGPT.
Additional Resources & Collaboration	Recommendations included optional pre-/post- materials and collaboration with other Army organizations to link basic and applied research.

3.2 Qualitative Course Feedback

The course participants were asked to give anonymous course feedback to a few questions where they were allowed to expand on their thoughts on the course. A screenshot of the survey is shown in Appendix E. The survey includes both their familiarity with AI coming into the course, followed by statements about the course that the participants were asked to give their agreement (or disagreement) with.

In this section, the feedback questions are presented in bold, followed by the supporting statements. The statements were categorized at the first level of the bulleted list, and the specific responses from participants are shown in quotations at the second level. The full comments are given in Appendix F.

What have you liked about the course? What should absolutely not be changed about the course? What were the things that impressed/interested you the most and what did you find the most helpful for your role in the Army?

Participants appreciated various aspects of the “AI for Soldiers” course, including the practical applications, knowledgeable instructors, and the mix of classroom learning with field trips. They valued the foundational mathematical concepts, real-world examples, and the opportunity to interact with researchers and scientists. The course’s structure, depth, and the professional learning environment were also highlighted as key strengths. Overall, participants found the course to be informative, engaging, and beneficial for their roles in the Army.

Practical Applications and Field Trips:

- “I really liked seeing how ARL is applying AI research to real world problems. I enjoyed the day at Robotics Research Collaboration Campus (R2C2), really appreciating the areas where researchers are challenged and how they’re progressing in the field. I enjoyed getting a greater appreciation for the hard problems, where AI isn’t necessarily the pixie dust.”
- “I enjoyed the mix of classroom learning and field trips that showed how the math applied. The researchers understood Army operations and Soldier needs.”
- “I liked the practical application days of the course and that should absolutely not be changed. For my role in the army, understanding the data input requirements for effective use of AI was very helpful.”

- “The expert instructors and lab tours were engaging and provided insights into the future direction of AI/ML in the military.”
- “The pace and content were great. Applied AI/ML, like lab tours and robotics, was the most interesting.”

Instructors and Course Structure:

- “I appreciated the ‘look behind the curtain’ at ARL. The course sparked my career interest in Army Aviation AI, and I now work with PEO-Aviation.”
- “I really enjoyed the fact that I was able to ask all sorts of questions in class. Although the math/logic portions of the course were a bit challenging, I thought they were fascinating. I really like the lab tours on Day 4 (do not take this out).”
- “The setup, instructors, and 1-week format were excellent—I wouldn’t change it.”
- “I liked understanding how AI works and the real-world examples that were provided. The instructors gave us background knowledge and then showed us times where it failed and where they had success.”
- “The instructors were knowledgeable. I was especially impressed by what large language models (LLMs) can do and how the Army is exploring them. Robotics was also a highlight.”
- “I liked the foundational math and the grounded, professional environment. The course helped me improve science communication and tailor future AI/ML questions.”

Foundational Concepts and Real-World Examples:

- “Although the math was rough, it was important to understand the foundation of AI and how it works. Understanding the capabilities of AI was a key takeaway for me.”
- “The research-based perspective helped cut through the industry hype. The depth and coverage were excellent.”
- “I enjoyed learning about different AI model types and how NLP connects linguistics and computer science. It will help me write better queries.”

- “The way the course continued to build on itself was excellent. Math was introduced really well and plenty of visual resources and good examples to reinforce learning.”
- “The in-depth explanations of different types of AI and ML, and descriptions of how they are trained, strengths and weaknesses.”

How could the course be improved? What would you have liked to have seen in the course, but didn’t?

While participants praised the overall quality of the course, several constructive suggestions emerged regarding its potential enhancement. Some attendees desired deeper dives into specific technical topics, such as neural networks and prompt engineering, while others suggested expanding hands-on exercises or tailoring content to different levels of familiarity with AI. Requests for additional case studies, Soldier-focused scenarios, and more discussion on implementation challenges in Army settings also surfaced. A few participants noted logistical considerations like course length, time for questions, and clarity of learning objectives. These reflections offer opportunities for refinement while preserving the core strengths of the course.

Curriculum Design & Delivery:

- “I would have appreciated some more scaffolding around the instruction. Some framing of the material and why it’s important. In some modules, I was open to the material, but it took me a minute to understand why it was important.”
- “If the course remains a 1-week course, I think that it needs to be more application focused with a broader (more wave top) overview of the math involved.”
- “The course HAS to be longer than a week and provided more frequently throughout the year.”
- “Two weeks—and possibly either a follow-on course or break it into 2 weeks with 1 week as the primer, then give the students something to study or look into until the next course.”
- “In my quantitative feedback, I mentioned that we sped through some presentations at breakneck pace without ample time to digest the presented in-

formation.”

- “Attempting to take notes and also comprehend the implications of some information was difficult at the lecture’s current pace.”
- “Understanding the constraints of the course, I believe I was positively overwhelmed with the content of the course.”

Hands-On Activities & Practical Use Cases:

- “I would have enjoyed more hands-on time to experiment with the applications and using AI/ML to solve military problems/questions.”
- “I think adding a small practical exercise, maybe 2–3 through the week. This will add practical use based on the information taught.”
- “Maybe a practical exercise of how to use NIPR-GPT or AskSage for some common tasks for leadership roles. This could be optional as homework if time is not possible.”
- “I think adding practical exercises on the different AI systems would be great. So that we are not only learning about the systems that are used, but we can do it in real time using AskSage or NIPR-GPT.”
- “I also think that some hands on problems to gain more experience with the problem set.”
- “We don’t need to be able to come away building our own AIs but hands-on examples that truly show where the technology WILL be useful and where it WILL NOT be useful in the future.”

Contextualization & Relevance to Army Use Cases:

- “Sometimes MAJ Work had to step in and explain why something mattered, I think that context would have been helpful up front as we dive into the modules.”
- “It would’ve been great to have a more robust read-ahead that provided an overview of the AI research community/ecosystem, strategy, and implementation.”
- “Also, recommend having one guest speaker who can talk about the application/fielding of AI into the Army (above Technical Readiness Level [TRL] 5).”

- “I think coming up with military examples for all of the problems discussed, instead of dog and cat categorization it could be tank versus car.”
- “Then students can double-check with instructors the next day for support.”

Learning Materials & Continued Learning Support:

- “It would’ve been great to have a more robust read-ahead. . . a read-ahead can provide references and information that we aren’t able to cover in-person.”
- “Guidance for continued learning, anywhere from recommended foundational math courses to techniques in science communication.”
- “I think having a couple of sessions where we learn how to make prompts for NIPR-GPT would be beneficial.”
- “Physical printouts/some sort of repository for the math proofs involved. Maybe even like a master reference book or 1–2 pager to complement the slides.”
- “I love math and would have enjoyed working through some very basic problem sets as we went along the first few days.”

Evaluation & Long-Term Engagement:

- “It would be great if we had a beginning of the course assessment and the end of the course assessment to see how we improved in our understanding of course material.”
- “Two weeks—and possibly either a follow-on course or break it into 2 weeks. . . Maybe like 6 months apart and give them a ‘project’ to work on.”

Course Access & Scalability:

- “Expand the course to accommodate more participants for broader dissemination of the content.”
- “Possibly a remote course that could reach a broader audience.”

Tech Demos & Experiential Learning:

- “When we split the group in half between the 2 teams of scientists on Thursday, the room containing the VR headsets I felt did not have a well-displayed and organized presentation for their work.”

- “I thought we would get to see a demo of the self-driving DARPA vehicles since they were running the entire time we were learning about them but was disappointed that we didn’t.”
- “Would have loved to see the Polaris RZR drive on its own—only kidding!”
- “For the tech demonstrations I would have preferred more in depth interaction with some of the systems under development.”
- “It would be better to see less tech get demonstrated, if students had a more in depth demonstration or even interaction with the tech.”

How do you envision using this knowledge upon returning? After completing this course, how do you plan on using what you learned to further the Army mission?

Participants expressed a wide range of ways they plan to apply the knowledge gained from the course to advance the Army mission. Many intend to educate others in their units, contribute to AI-related projects, or evaluate emerging technologies more critically. Others highlighted specific goals, such as improving data pipelines, integrating AI into decision-making processes, or supporting Army modernization efforts. Several participants mentioned sharing lessons learned through briefings and professional development sessions, while some are already collaborating with research teams or transitioning into roles directly tied to innovation and technology. Across all responses, there was a shared sense of excitement and responsibility to help shape how the Army adopts and implements AI capabilities.

Applying AI Knowledge to Current or Upcoming Assignments:

- “This summer I will PCS to Defense Innovation Unit (DIU) and I hope to work on AI projects there. I have a much greater appreciation for how these tools work, the potential for solutions, and the limitations of tools. I feel much better equipped to approach these projects now and have a great basis on which to build.”
- “I am already working with the DEVCOM team to try and implement Enhanced Tactical Inferencing (ETI), as well as the DEVCOM team on the Chem/Bio side to see how we can improve some of the chemical, biological, radiological, or nuclear (CBRN) sensors integration through AI. I see building upon what we have learned already and breaking into some great

experimentation efforts at the Training and Doctrine Command and at the schoolhouses to see what AI can provide for the Warfighting Functions, especially as we look into 2030 / 2040 and the Human–Machine Integrated Formations (HMIFs).”

- “I plan on being more involved with information management projects in my professional capacity.”
- “Improving Army Aviation business processes, data pipeline management, and connecting both lateral and vertical digital communications among warfighting functions that directly affect the aviation mission.”

Enhancing Team or Organizational Awareness:

- “I envision spending more time with the AI/ML applications that I have access to: PowerBI, MAVEN, NIPR-GPT, AskSage. I also plan to provide a Leader Professional Development (LPD) to my coworkers, so they can understand how to utilize AI as a tool with human oversight, and what emerging technology is being worked.”
- “I will brief my unit on the course content and share available AI/ML software for military members.”
- “I plan to help educate other leaders in my organization about the limitation and opportunities of using AI. I think this knowledge is so important given the constant inundation of vendors who keep wanting to sell us their products. We also need to understand how AI is going to affect the information environment in the future.”
- “I intend to use what I learned to spread the word on the many different AI systems and how to approach them. I think people assume AI knows all, but it is important to understand its limitations, so you know how best to use it.”

Improving Personal Efficiency and Productivity:

- “I want to try to incorporate AI into my daily use to help me use my time more efficiently so I can spend my time doing other things.”
- “The course is a great foundation and was very fulfilling. I feel confident I can use methods taught in the course to help me and my peers at my work to

improve speed and accuracy in some areas of work. My first plan after this course is filtering through large amounts of unstructured data to categorize and organize. To later improve our methods of processes and actions within my office.”

Informing Strategic Decisions and Army Concepts:

- “This class also gave me a spark of excitement about the Army of the future and what will be different, how we must change to become more lethal, and how to do better with what we already have.”
- “This course will help me inform the drafting of the Army concept and identify emergent capabilities for future employment.”
- “Several ideas – Human Resources-related career progression models as well as being that translator when vendor X is selling cutting edge tech for Air Defense. I will also use the opportunity to identify when a process or procedure could leverage AI/ML/Automation to increase the speed of decision-making, lethality, and out-pacing our enemies.”
- “The course gave me a better familiarity with AI concepts, to better guide how I research for information on AI and associated technologies for inclusion in future Army concepts and experimentation. The course also gave me a better understanding of the Army AI portfolio and research points of contact.”

Developing Critical Thinking and Data Framing Skills:

- “I plan to help my subordinate commanders and those I work with to better frame problems. Data is beneficial, but understanding the problem set goes a long way to solving it.”
- “Understanding how to collect the right data the right way is the biggest take away to allow our unit to properly use this technology in the future.”
- “I envision myself able to provide context for what our incoming AI tools will or will not be capable of depending on their underlying models. I also anticipate a better ability to write effective queries when requesting complicated or nuanced sets of data.”

4. Impact and Future Directions

4.1 Impact to the Army

To explore the value of this course in equipping Soldiers and Army leaders to engage meaningfully with artificial intelligence, we invited a few participants from the 2024 Artificial Intelligence Strategic Broadening Seminar to reflect on its impact. Their responses highlight the importance of sustained AI education across the force and describe immediate changes in how they approach problem-solving, assess workflows, and evaluate the practical use of AI tools within their organizations.

One participant described the course as “transformative,” offering a foundation for identifying AI use cases and shaping complex problem statements. He noted that “through exposure to advanced AI concepts and interdisciplinary collaboration at ARL, participants gained essential insights into neural networks, the capabilities and limitations of machine learning models, developing organizational trust, and discovering approaches to lateral and vertical AI integration at each echelon of Army enterprise operations.” For his domain, the course inspired a strategic mindset shift toward leveraging artificial intelligence for “data management, decision-making, sustainment analytics, domain knowledge continuity, and improvement of warfighting function workflow efficacy.” He concluded that the seminar “established a clear pathway for developing and implementing innovative AI-driven solutions while fostering a proactive culture of technological adoption within the strategic alignment of Army Aviation and the Army Enterprise.”

Another participant reflected more succinctly: “In short, it was great. I immediately saw paths and methods to integrate ML/AI into my current workflows, and understanding how it works—and how it could be misapplied—helped me build in appropriate checks.” He cited examples such as using generative tools for writing, data analysis, and trend recognition, adding that the experience gave him a clearer sense of the Army’s ongoing efforts to integrate AI, particularly in areas of research and development that many participants had not previously been aware of.

Taken together, these perspectives underscore the potential of targeted AI education to shape not only technical understanding but also strategic thinking, practical adoption, and cultural readiness. They affirm that well-designed courses can catalyze innovation and inspire leaders to thoughtfully integrate AI within their organizations,

aligning with broader Army modernization goals.

4.2 Suggestions for Future Iterations and Improvement

Based on feedback and observed outcomes, several areas of last year's course were successfully improved in this iteration. Participants experienced more-reliable Wi-Fi connectivity, benefited from clearer guidance and dedicated time for capstone projects, and the course reached a well-aligned audience, suggesting more effective targeting and communication during recruitment. These refinements contributed to smoother course execution and a more focused learning environment.

At the same time, a number of recurring themes and suggestions highlight ongoing opportunities for refinement. Based on participant feedback, five key areas emerged that could be pursued in future iterations. Many comments centered on expanding course content—recommending the inclusion of additional topics, deeper exploration of Army-specific use cases, or more coverage of current AI trends. At the same time, there were strong calls to slow the course pace, increase time for discussion and group work, and allow space for deeper reflection. These suggestions, while all constructive, often compete with one another and present a tradeoff between breadth and depth.

1. Continue Targeting and Preparing the Right Audience

The current audience mix—with appropriate levels of interest and technical background—appears well matched to the course objectives. Continued clarity about course expectations and goals can help sustain this alignment in future iterations.

2. Balance Technical Depth and Accessibility

Mathematical content continues to elicit mixed responses. Some participants find it essential to understanding how AI works, while others would prefer more high-level context. Offering optional supplemental sessions or framing the math with clear practical relevance could help meet diverse learning preferences.

3. Expand Pre- and Post-Course Materials

Suggestions included more structured pre-course materials or follow-up resources to reinforce learning. Even lightweight or optional content could help

participants engage more deeply, though care will be needed to balance preparation expectations with participants' (and instructors') time constraints.

4. Increase Time for Discussion and Application

Participants expressed a desire for more interactive components, small-group work, and scenario-based exercises. Incorporating discussion into lecture segments or creating short, focused breakout sessions could help address this feedback without significantly extending the course schedule.

5. Further Integrate Army-Relevant Use Cases

There remains strong interest in seeing how AI is applied across the Army. Continued engagement with operational units or the inclusion of guest speakers from relevant organizations could add practical relevance and inspiration.

Taken together, this feedback underscores the challenge of expanding content while also allowing more time for interaction and reflection. Future iterations will need to carefully weigh these competing priorities to maintain an experience that is both rigorous and accessible.

5. Conclusion

This course continues to evolve in response to participant feedback, emerging technologies, and the growing importance of artificial intelligence across the Army. The improvements implemented since the previous iteration contributed to a smoother experience and reinforced the course's value as a foundational introduction to AI for Soldiers.

As interest in this domain expands, future offerings will benefit from continued refinement—balancing depth and accessibility, technical insight and practical application, and structured content with time for reflection. With thoughtful iteration and sustained engagement, the course can remain a meaningful contributor to AI education and innovation within the Army enterprise.

Appendix A. AI for Soldiers Course Detailed Schedule

This appendix appears in its original form, without editorial change.

Foundation & Application of Artificial Intelligence and Machine Learning

	Monday, April 7, 2025		Tuesday, April 8, 2025		Wednesday, April 9, 2025		Thursday, April 10, 2025		Friday, April 11, 2025					
	What	Where	What	Where	What	Where	What	Where	What	Where				
8:00 AM - 8:15 AM	Arrival	ALC Zahl Seminar Room	Keynote Speaker: Dr. Scott Schoenfeld ARL Chief Scientist	ALC Zahl Seminar Room	Keynote Speaker: Dr. John Fossaceca ARL Division Chief Science Intelligent Systems	ALC AVL VisLab	Keynote Speaker: Mr. Dietrich Wiegmann ARL Division Chief Military Info Science	ALC Zahl Seminar Room	Keynote Speaker: MG Ahern HQDA	ALC 5th Floor Conference Room 516				
8:15 AM - 8:30 AM	AI4Soldiers Course													
8:30 AM - 8:45 AM	Introduction													
8:45 AM - 9:00 AM	Dr. Mark Tschopp													
9:00 AM - 9:15 AM	Keynote Speaker: COL Wagner, FCC Director of Concepts		AI/ML 101 Dr. Mark Tschopp		Morning Break									
9:15 AM - 9:30 AM														
9:30 AM - 9:45 AM														
9:45 AM - 10:00 AM														
10:00 AM - 10:15 AM	Morning Break		Morning Break		Intro to Robotics Dr. Reggie Hobbs									
10:15 AM - 10:30 AM	Intro to AI Dr. Reggie Hobbs		AI/ML 101 Dr. Mark Tschopp				Travel to Graces Quarters (in transit)							
10:30 AM - 10:45 AM														
10:45 AM - 11:00 AM														
11:00 AM - 11:15 AM														
11:15 AM - 11:30 AM							Natural Language Processing Dr. Reggie Hobbs							
11:30 AM - 11:45 AM														
11:45 AM - 12:00 PM														
12:00 PM - 12:15 PM														
12:15 PM - 12:30 PM	Lunch Break	ALC Cafeteria	Lunch Break	ALC Cafeteria	Lunch Break		Lunch Break	Emmerman Lab 4F031	Lunch Break					
12:30 PM - 12:45 PM														
12:45 PM - 1:00 PM														
1:00 PM - 1:15 PM														
1:15 PM - 1:30 PM	Intro to AI Dr. Reggie Hobbs	ALC Zahl Seminar Room	AI/ML 101 Dr. Mark Tschopp	ALC Zahl Seminar Room	Robotics Demo	Graces Quarters R2C2 Robotics Research Collaboration Campus	AI in Action: MIS	ALC Zahl Seminar Room	Keynote Speaker: Dr. Pat Baker ARL Director					
1:30 PM - 1:45 PM														
1:45 PM - 2:00 PM														
2:00 PM - 2:15 PM														
2:15 PM - 2:30 PM	Afternoon Break		Afternoon Break											
2:30 PM - 2:45 PM														
2:45 PM - 3:00 PM														
3:00 PM - 3:15 PM														
3:15 PM - 3:30 PM	Intro to AI Dr. Reggie Hobbs		AI/ML 101 Dr. Mark Tschopp		Capstone Team									
3:30 PM - 3:45 PM														
3:45 PM - 4:00 PM														
					Travel to ALC (in transit)									

Appendix B. AI for Soldiers Course Information Package

This appendix appears in its original form, without editorial change.

Artificial Intelligence for Soldiers



Prompt: [Microsoft Bing Image Creator] Envision a surreal battlefield landscape where algorithms and equations replace traditional tanks and soldiers. Graphs, matrices, and decision trees form the terrain, while military officers navigate this abstract warzone. A giant AI brain hovers ominously in the sky, controlling the chaos.

Artificial Intelligence for Soldiers

Course Overview

Course Title: Artificial Intelligence for Soldiers

Target Audience: Mid-career Army staff officers with no coding background, holding undergraduate degrees, seeking to enhance their understanding of Artificial Intelligence (AI) and Machine Learning (ML).

Course Capacity: Up to 25 students per class, with a minimum of 20 participants required.

Preferred Format: In-person course over a two-week schedule.

Funding: Travel and TDY costs funded by HQDA, G3/5/7.

Course Content:

This course aims to orient learners to concepts within artificial intelligence and the sub-group of machine learning as it pertains to the Army. Participants will gain intermediate knowledge of the different families of machine learning algorithms, training data needed for each, and the appropriate application and limitations of each. The curriculum covers handcrafted knowledge AI versus machine learning AI approaches and explains key factors driving recent improvements in machine learning performance. Additionally, participants will develop a basic understanding of neural networks and how they work. Strategies for applying AI to discrete and complex data sets to solve business, strategic, or logistical problems will be provided, with tools and strategies synthesizable to novel situations in diverse organizational settings, including military environments.

Objectives:

- Enable Army officers to provide senior leaders with data-driven decision-making abilities previously unavailable, allowing them to seize opportunities that provide a competitive advantage over adversaries.
- Enable Army officers to understand and direct approaches for leveraging data and algorithms to achieve their goals.
- Increase staff officers' ability to determine potential, previously unconsidered applications for business and strategic decision-makers.
- Enable Army officers to provide real-world perspectives to ARL leaders on problems where AI capabilities could yield transformational change.

This course is designed to equip participants with the knowledge and skills needed to effectively utilize AI in military contexts, fostering innovation and strategic decision-making.

ARTIFICIAL INTELLIGENCE FOR SOLDIERS

FOUNDATIONS OF ARTIFICIAL INTELLIGENCE / MACHINE LEARNING

DAY 1

WELCOME

MODULE

1

AI

CAPSTONE
SCENARIO

MODULE

2

AI

DAY 2

MODULE

3

AI/ML

MODULE

4

AI/ML

DAY 3

MODULE

5



AI

in
ACTION

R2C2



DAY 4

MODULE

6

NLP



AI

in
ACTION



IOIO
IOIO



DAY 5

CAPSTONE
FEEDBACK

COURSE
FEEDBACK

FINAL
CAPSTONE
PROJECT

AI4SOLDIERS
GRADUATION

Course Schedule

	Monday April 7 (Day 1)	Tuesday April 8 (Day 2)	Wednesday April 9 (Day 3)	Thursday April 10 (Day 4)	Friday April 11 (Day 5)
AM	Module: AI Introduction I AI History and Applications	Module: Introduction to Data and Machine Learning	Module: AI and Robotics	Module: Introduction to Natural Language Processing (NLP)	AI Capstone and Course Feedback, Capstone Final Preparation
PM	Module: AI Introduction II + Introductions\ Capstone	Module: Introduction to Neural Networks	AI in Action: Robotics Research Collaboration Campus (R2C2)	AI in Action: ALC AI/ML Applications	AI Capstone Project Presentations, Graduation Ceremony
Where	Zahl	Zahl	Graces Quarters	Zahl	ALC 5 th Floor
Leads	RH, MT	MT, RH	JF, RH, MT	RH, MT	RH, MT

Week 1: Foundations of Artificial Intelligence and Machine Learning

- Day 1: Understanding AI Concepts and Fundamentals
 - Morning Session: Introduction to AI and its Applications
 - Afternoon Session: Team Introductions and Scenarios
- Day 2: Machine Learning Basics to Neural Networks: How They Work
 - Morning Session: Introduction to Machine Learning & Neural Networks
 - Afternoon Session: Complex Neural Network Architectures
- Day 3: Robotics and Autonomy 101
 - Morning Session: AI and Robotics Integration
 - *AI in Action: Robotics Research Collaboration Campus (R2C2)*
- Day 4: Natural Language Processing and AI/ML
 - Morning Session: Introduction to Natural Language Processing (NLP)
 - *AI in Action: Lab Tours and Demonstrations*
- Day 5 (Final): AI Capstone Project Presentations and Graduation Ceremony
 - Morning Session: Feedback and Final Preparation
 - Afternoon Session: AI Capstone Project Presentations and Graduation Ceremony

Program Module Abstracts

Multiple modules from prior 2-week course will be consolidated for this 1-week course.

Module 1

INTRODUCTION TO ARTIFICIAL INTELLIGENCE, Part I

Instructor(s): Dr. Reggie Hobbs

AI Problem Solving. Welcome the Artificial Intelligence for Soldiers course! This first module sets the stage for the course, providing an introduction to artificial intelligence, its history, and the foundational concepts that will be explored throughout the program.

Module Topics:

- Evolution of Artificial Intelligence – This topic explains the fundamentals of artificial intelligence, providing definitions and discussing the disciplines contributing to AI.
 - Intelligent Agents – An introductory discussion explores the nature of intelligent agents, examining their capabilities and roles within AI systems.
 - Fundamentals of Search and Adversarial Search (Games) – Participants delve into algorithmic problem-solving approaches, exploring how agents find solutions through search algorithms. The module also covers adversarial search strategies, particularly in competitive environments where conflicting goals exist, often illustrated through game scenarios.
-

Module 2

INTRODUCTION TO ARTIFICIAL INTELLIGENCE, Part II

Instructor(s): Dr. Reggie Hobbs

Knowledge and Reasoning. This module explores the foundational aspects of AI, focusing on Knowledge and Reasoning. It delves into the design of intelligent agents capable of understanding and navigating a complex world through logical inferencing. Additionally, various techniques for representing real-world knowledge within AI systems are covered, enabling effective problem-solving and decision-making in uncertain or limited data environments. Through this module, participants gain essential insights into the cognitive processes underlying intelligent behavior in artificial systems.

Module Topics:

- Logical Agents and Inferencing – This topic delves into the design of intelligent agents capable of forming representations of complex environments, utilizing inferencing to derive new representations, and deducing next steps based on the updated internal model.
 - Knowledge Representation – Participants will receive an overview of techniques employed by AI systems to represent diverse facts about the real world in a format conducive to reasoning and problem-solving.
 - Automated Decision Making – This topic explores rule-based approaches that enable agents to make decisions even when faced with limited or uncertain data.
-

Module 3

INTRODUCTION TO MACHINE LEARNING

Instructor(s): Dr. Mark Tschopp

Machine learning here, machine learning there, machine learning everywhere! This module will tackle the concepts, the math, and the algorithms of machine learning for those that are slightly familiar, somewhat familiar, or not at all familiar with the topic. Starting at the very beginning with the simplest machine learning algorithms such as linear and logistic regression, this module will embark on describing the many concepts important for understanding what goes on inside machine learning algorithms, arguably the “engine” that powers many advances today in artificial intelligence. To describe the algorithms and concepts further, this module uses Microsoft Excel to show the underlying math that permeates machine learning.

Module Topics:

- Data is the New Bacon. A fun intro and overview of the importance of data within machine learning and artificial intelligence. Pop culture anecdotes, data analysis & visualization, data science and ML, data ethics and privacy, data-driven decision making, the future of data!
- Machine Learning Primer. A gentle introduction to machine learning concepts including a simple supervised machine learning example. The topics covered include:
 - 2-day ML course structure,
 - why machine learning AI,
 - types of machine learning (supervised vs unsupervised),
 - the simple math of (supervised) machine learning, and
 - a simple dog-cat example.
- Machine Learning Basics. All the important machine learning concepts needed to understand neural networks and deep learning, without the neural networks. The topics covered include:
 - regression and classification,
 - linear regression,
 - loss and cost functions,
 - gradient descent and optimization,
 - logistic regression,
 - variance vs bias tradeoff,
 - regularization, and
 - training set, dev set, test set.

Module 4

INTRODUCTION TO NEURAL NETWORKS

Instructor(s): Dr. Mark Tschopp

These days, whenever someone says, “Don’t worry, I’m using machine learning,” it usually means that they are using some sort of neural network architecture (and quite possibly that you should worry). Building on the introduction to machine learning (Module 3), this module dives into what makes up the standard neural network architecture. Many of the concepts introduced for simple algorithms are very similar to the concepts used within neural networks, with a few deviations. This module will explore how simple perceptron models—the building blocks of neural networks—can be copied multiple times to make up a

layer of nodes and can then be expanded into multiple layers to make “deep learning” neural networks. This module sets the stage for the more complex neural network architectures that to be covered on Day 3.

Module Topics:

- **Neural Network Basics.** The basic concepts within conventional neural networks, building upon those learned from linear/logistic regression. The topics covered include:
 - deep learning,
 - perceptron,
 - increased complexity of simple neural networks (hidden layer, multiple nodes),
 - forward propagation and backpropagation,
 - activation functions,
 - optimization methods,
 - initialization and regularization,
 - Excel and python examples.

Module 5

NEURAL NETWORKS ARCHITECTURES FOR IMAGES, COMPRESSION, and GENERATIVE AI

Instructor(s): Dr. Mark Tschopp

Data doesn't always come in nice data tables with clear inputs and outputs. This module starts to look at data that comes in much different forms: from images to unstructured text. First, a fun talk about when machine learning goes wrong, i.e., real-world applications that have failed in big ways and have been publicized through various media outlets. Then, a look at how some unstructured data, like text and categories can be transformed into structured data for ingestion into machine learning models. This module will then tackle 1) how convolutional neural networks take on image data, 2) how autoencoders compress and decompress data, and 3) how generative adversarial networks take advantage of two competing neural networks to produce fake data that is almost as good as the real data.

Module Topics:

- **AI/ML Real-World Examples.** A fun and informative deep dive into the good, the bad, and the ugly of AI have been publicized via various media outlets. From AI defeating Gary Kasparov to Alpha Go to Amazon's Sexist hiring algorithm to adversarial-perturbed 3D printed turtles to Microsoft's chatbot-turned-racist Tay.ai, this section is an entertaining and concerning look at AI in the wild.
- **Feature Encoding.** As a precursor to looking at unstructured text data, this section is a brief look at how categories can be turned into numerical features for ingestion into machine learning models. The topics covered include:
 - label (ordinal) encoding,
 - one-hot encoding and dummy encoding,
 - target mean encoding, and
 - dealing with overfitting in target mean encoding.
- **Convolutional Neural Networks.** When dealing with data in the form of images and videos and signals, convolutional neural networks take advantage of local information around a specific point, identifying local patterns and relationships. The topics covered include:
 - what are convolutions,

- convolutional neural network building blocks,
- filters in hidden layers and saliency maps,
- different CNN models and ImageNet,
- advanced architectures (Inception, ResNet),
- transfer learning,
- reinforcement learning with CNNs,
- simple Python examples.
- Autoencoders and Generative Adversarial Networks. Neural networks can also be used to compress the dimensionality of data (encode), to expand data into higher dimensions (decode), and to generate new fake data (GANs). The topics covered include:
 - autoencoders and stacked autoencoders,
 - regularization in autoencoders—variational autoencoders,
 - latent space in autoencoders,
 - anomaly detection and autoencoders,
 - generative adversarial networks concepts, and
 - deepfakes.

Module 6

NEURAL NETWORKS ARCHITECTURES FOR SEQUENCES AND TEXT

Instructor(s): Dr. Mark Tschopp

OpenAI's ChatGPT took the world by storm. Less impressive language models were released prior to this, but these were quickly pulled offline based off of user feedback. But how do you take an entire corpus of digitized text from books, from the Internet, and from other sources and use it to train billions of parameters for a model that converses intelligently with a diverse set of users all over the world? This module explores sequence models and provides a brief introduction to what's happening under the hood of some of the simpler natural language processing models.

Module Topics:

- Sequence Models. When data is in the form of sequences where context is important, sequence models can use that adjoining information to improve the predictions. The topics covered include:
 - anomaly detection example for time series (sequence),
 - one-to-many, many-to-one, many-to-many model examples,
 - recurrent neural networks,
 - gated recurrent unit models,
 - long/short term memory models,
 - an example in Excel,
 - cross-validation for sequences, and
 - text-to-image network examples—Dall-E, Bing Image Creator, Midjourney.
- Natural Language Processing. When the data is an enormous corpus of text, like every digitized book ever or the entire Internet, natural language processing combined with neural network architectures is a powerful tool. The topics covered include:
 - the basics of NLP,
 - Allen NLP—question-answer models, masked language models,
 - structured data versus language,
 - words-to-numbers—the embedding vectors,

- word similarity,
- co-occurrence matrices,
- GloVe global (word) vector and its properties, and
- Word2Vec—skipgram and continuous bag of words.

Module 7

INTRODUCTION TO NATURAL LANGUAGE PROCESSING

Instructor(s): Dr. Reggie Hobbs

Natural Language Processing (NLP) has emerged as a defining moment in the trajectory of artificial intelligence. This module explores the pivotal role NLP plays in contemporary AI developments.

Module Topics:

- Overview of Natural Language Processing – This topic delves into how intelligent systems leverage natural language to interact with humans and learn from textual data. It includes a brief explanation of the fundamental components of natural language.
- Automated Speech Recognition – Participants will gain insights into the methods and techniques enabling intelligent systems to recognize and transcribe spoken language into text.
- Deep Learning for NLP – The module discusses the application of deep neural networks in various language tasks, capturing the intricate structure of natural language from training data. Additionally, it provides an overview of the transformer architecture, which, in conjunction with abundant data and high-performance computing resources, has facilitated the development of large language models and the emergence of Generative AI capabilities.

Module 8

PRACTICAL APPLICATIONS OF NLP

Room: ALC, NSRL (Network Science Research Laboratory)

Instructor(s): Dr. Reggie Hobbs

Natural Language Tasks. This module explores various natural language processing tasks essential in modern AI applications.

Module Topics:

- Information Extraction - Participants will delve into the use of computer systems to automatically extract structured information from unstructured or semi-structured machine-readable documents. This process enables computation on previously unstructured data and supports automated reasoning about the logical form of input data.
 - Question Answering and Summarization – This topic provides an overview of computational linguistic approaches that generate phrases, sentences, and paragraphs in response to user queries in natural language. These techniques facilitate focused information retrieval across documents.
 - Dialogue and Conversational Agents – Participants will gain insights into intelligent systems designed to communicate directly with humans using natural language. The module covers aspects such as tracking verbal transactions, determining speaker intent, handling ambiguity, and addressing uncertainty arising from vague input.
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Module 9

ARTIFICIAL INTELLIGENCE AND ROBOTICS INTEGRATION

Instructor(s): Dr. Reggie Hobbs, Dr. John Fossaceca

This module provides an introduction to the integration of artificial intelligence and machine learning with robotics and autonomous systems. The module also includes a briefing about the R2C2 at Grace's Quarters, followed by a tour of the facilities and demonstrations of autonomous platforms.

Module Topics:

- Introduction to Intelligent Robotics: Participants will be introduced to the fundamental concepts and principles of intelligent robotics.
 - Behavior Based Robotics: The module explores the principles behind behavior-based robotics, focusing on the design and implementation of robotic behaviors.
 - Human-Robot Interaction: Participants will examine the various aspects of human-robot interaction, including communication modalities and interface design.
 - Autonomous Systems for the Army: This topic covers the deployment and application of autonomous systems within military contexts, with a focus on Army operations.
 - Artificial Intelligence for Maneuver and Mobility (AIMM): Participants will learn about the role of artificial intelligence in enhancing maneuverability and mobility in military settings.
-

Group AI Capstone Project

The Artificial Intelligence for Soldiers course facilitates the knowledge process by allowing teams to formulate how machine learning and artificial intelligence concepts can potentially be used in the future. The objective/task for the scenario is purposely left open-ended for the teams to formulate where there might be an opportunity based on the skillsets of the team.

Some questions that may be useful in discussions:

- A. Objective and Impact of AI Implementation.
 - a. How would this objective/task be approached without AI/ML, and what is the current state of the art?
 - b. How could AI/ML improve predictions and decision-making speed?
 - c. Could AI fundamentally alter strategy or direction, and if so, how?
- B. Data Considerations.
 - a. What data is available for training, and how reliable is it?
 - b. Which features are most relevant, and how can missing or noisy data be managed?
 - c. How can data collection and model validation be conducted effectively?
 - d. Is there a discrepancy between training and real-world data, and if so, how can it be identified?
- C. Algorithm Selection and Implementation.
 - a. Which ML algorithms are suitable for the problem, and why?
 - b. How do we balance complexity and interpretability? (hint: think variance vs bias tradeoff)
 - c. Can algorithms be scaled effectively, and how do we defend against adversarial attacks or failures?
 - d. Are there tradeoffs between speed and accuracy?
 - e. Can pre-trained models be used, and how?
- D. Human-AI Interaction.
 - a. How can user interfaces effectively communicate AI capabilities and limitations?
 - b. How can user feedback be incorporated to improve AI performance?
 - c. What strategies can build trust between users and AI systems to increase useability of AI systems?
 - d. What educational resources are needed for users to understand and interact with AI effectively?
 - e. How can AI systems augment human decision-making while respecting human autonomy?
 - f. How could Soldiers at different echelons employ AI to meet their goals?
- E. Ethical and Risk Considerations.
 - a. What ethical concerns and risks are associated with AI implementation?
 - b. How can potential harmful outcomes be addressed, and who is responsible?
 - c. What privacy and security concerns need to be addressed?
 - d. How can AI systems be held accountable for their actions? If not AI, who is accountable?
 - e. What measures can mitigate potential biases or risks?

It is envisioned that there will be time each day towards the end of the day for teams to meet and discuss the various concepts learned throughout the day and how they may apply to the objective/task/scenario chosen.

Travel Instructions

Location/Arrival

The Combat Capabilities Development Command (DEVCOM) Army Research Laboratory (ARL) is a large government-owned research facility, one of the main performers and funders of foundational research for the Army. The venue for the course is DEVCOM ARL's Adelphi Laboratory Center (ALC)—its headquarters and one of the ARL research campuses. This facility is located 12 miles north of Washington, DC in Adelphi, MD.

Adelphi Laboratory Center (ALC)
2800 Powder Mill Road
Hyattsville, MD 20783

There are two major Airports within the region: Ronald Reagan-Washington National Airport (DCA), and Baltimore/Washington International Airport (BWI). BWI has less traffic to navigate in and out of, but DCA is closer to the facility. A third option is Dulles (IAD), VA.

- BWI to ALC: 25.1 miles (about 30 minutes)
- DCA to ALC: 16.1 miles (about 40 minutes)
- IAD to ALC: 32.5 miles (about 40 minutes)

Please contact ground transportation for transport to the Home2Suites hotel in Silver Spring, MD. If possible, coordinate your arrival time to link up with those Soldiers designated as authorized rental carpool drivers.

Registration/Check-in. On Day 1, proceed to ARL's Adelphi Laboratory Center (ALC). Upon entering the facility, we have set up a registration table where participants can check in, receive badges and/or lanyards, check to make sure that name is listed correctly (for certificates). The program begins with a welcome ceremony at the main campus ARL classroom of Monday, 7 APR 25 at 0800 ET.

Participants are expected to arrange for travel to and from ALC before and after class. For those driving, there are parking lots located outside of the laboratory. Participants will need to show their CAC card to security to enter the gate. Upon entering the campus, take the first right and then parking should be on the right. The main building is right across the street.

For days that we will be traveling to another location, participants should still meet at ALC at the designated start time (0800 AM ET), where transportation will use a 44-person bus. This occurs for the visit to the robotics campus at Graces Quarters on Wednesday, 9 APR 25.

Meal and Lodging Information

Lunches may be provided for some days at a cost – this will be discussed onsite. ALC also has a cafeteria with multiple options for hot/cold lunch. Bringing your own lunch is also an option.

Plan to arrive at the hotel, NLT 2000 ET, 6 APR 2025. A block of rooms has been reserved under "Army AI Conference" at Home2Suites:

Home2Suites by Hilton
1701 Elton Road
Silver Spring, MD 20903

Technology Requirements

You must have a laptop or other device that is CAC enabled for the program.

Wi-Fi will be provided by ARL during each day in the classroom. Wi-Fi is available at the Home2Suites but is not guaranteed to support high-speed connections.

The AI capstone project, in particular, may require a laptop with access to Microsoft PowerPoint for final presentation.

Assignments and Assessments

For assignments and assessments, the primary requirement for successful completion of the course is the submission of:

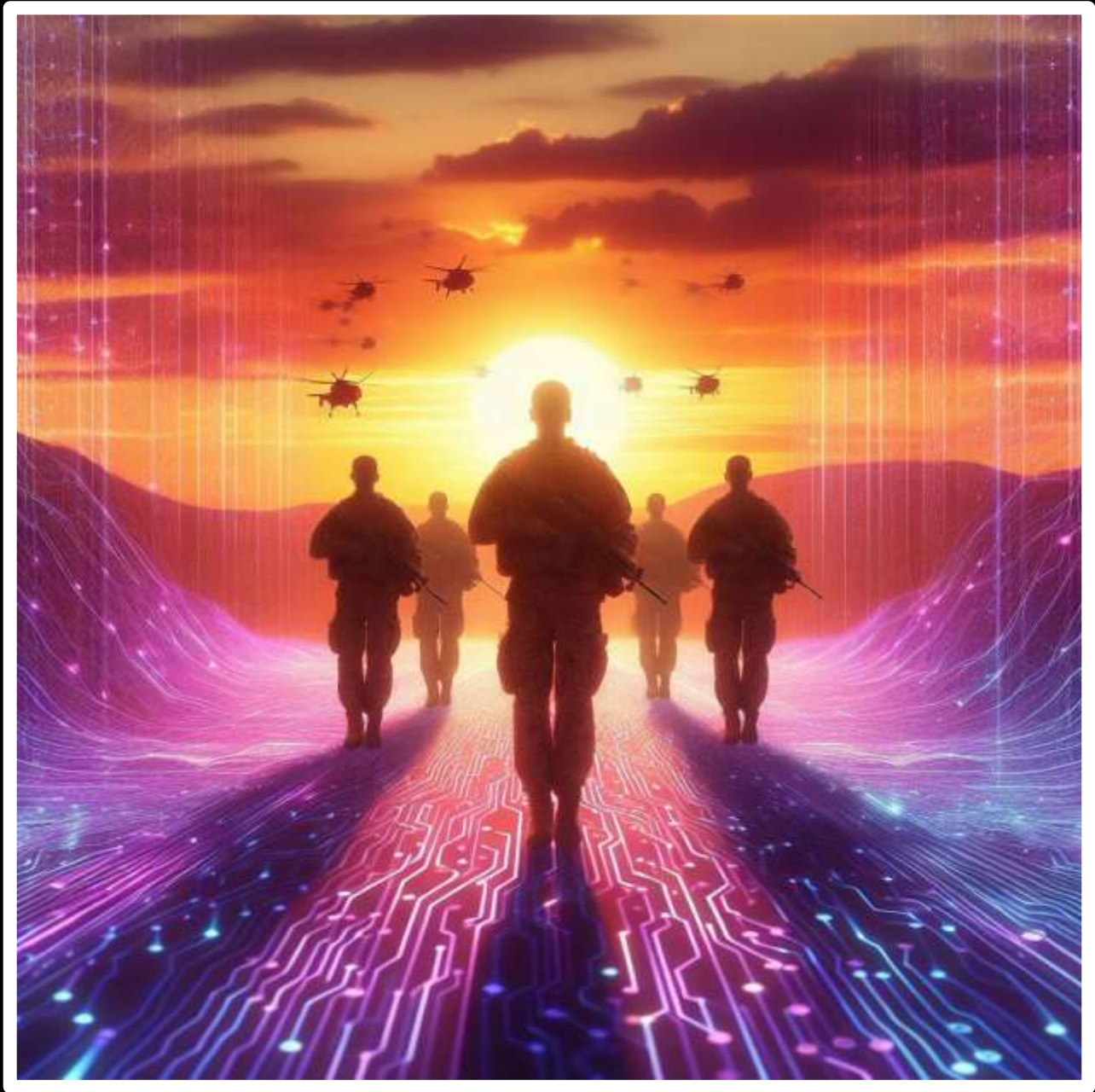
- the final course feedback,
- and the delivery of the AI capstone project presentation.

The deadline for the AI capstone project presentation is the final day of the course, prior to the graduation ceremony. To aid in the completion of the AI capstone project and course feedback, each soldier will be provided with a notebook to track notes and thoughts throughout the duration of the course.

Feedback Mechanism

On the last day, participants will be asked to provide feedback for the course: what they thought worked well, what didn't work well, what suggestions they have for improving the course. This information is critical to improving the course in the future.

Artificial Intelligence for Soldiers



Prompt: [Microsoft Bing Image Creator] Imagine a serene sunset scene where US soldiers, their forms outlined in shadow, walk purposefully toward the horizon. The backdrop is a blend of warm oranges and purples, with the sun casting long shadows. However, instead of a traditional landscape, the ground beneath their feet is composed of intricate AI algorithms, neural networks, and lines of code. These digital pathways lead toward the vanishing point, symbolizing the soldiers' journey into an AI-driven future.

Appendix C. AI for Soldiers Course Pictures

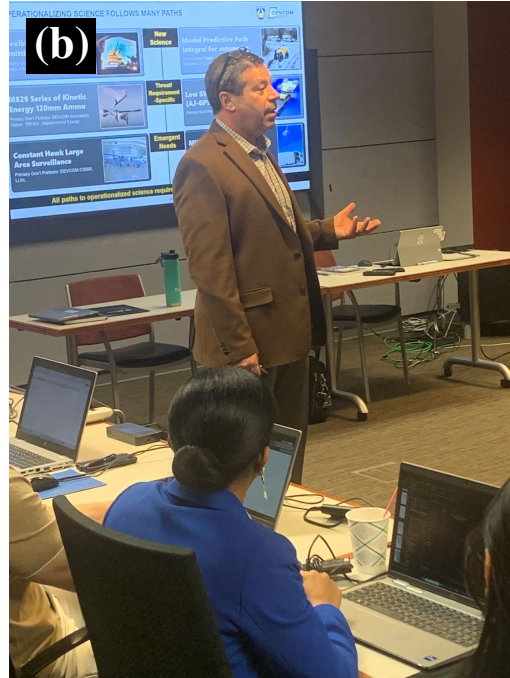


Figure C-1. Invited keynote speakers shared their perspectives during the AI for Soldiers course: a) COL Michael Wagner, Futures and Concepts Center, b) Dr. Scott Schoenfeld, ARL Chief Scientist, c) Dr. John Fossaceca, ARL Science of Intelligent Systems Division Chief, d) Mr. Dietrich Wiegmann, ARL Military Information Science Division Chief.

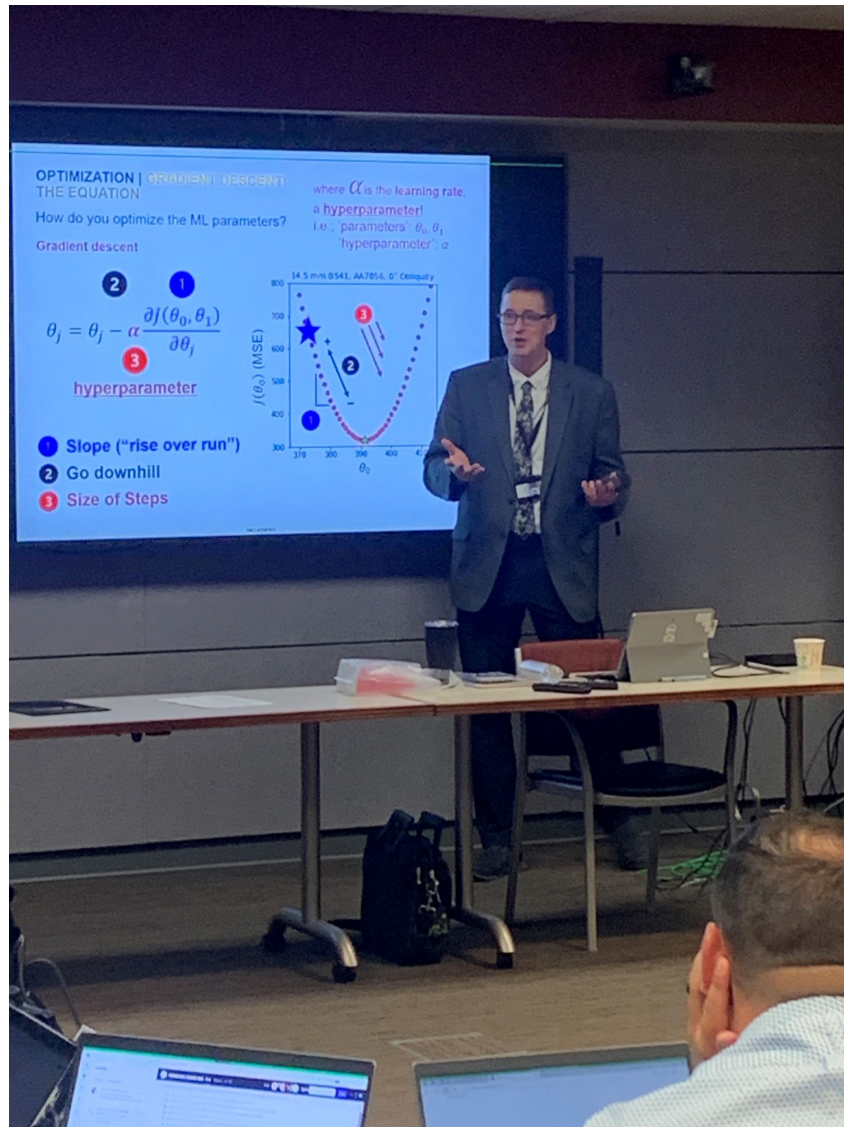


Figure C-2. Dr. Tschopp presents concepts and math of machine learning on Day 2.



Figure C-3. Robotics science demonstrations/briefs at Graces Quarters R2C2 during the AI in Action portion of the course on Day 3: (top) ARL researchers discuss development and experimentation of algorithms enabling autonomous ground vehicle to maneuver on unstructured off-road terrain and (bottom) ARL researchers demonstrate Generative AI integration with legged robots for human-machine teaming.



Figure C-4. Laboratory science demonstrations/briefs during the AI in Action portion of the course on Day 4: (top) AI for Soldiers participants pose with legged robot during the mixed reality common operating picture demonstration; (bottom) Dr. Adrienne Raglin presents AI research in the Content Understanding Branch.



Figure C-5. MG Stephanie Ahern, Director of Strategy, Plans, and Policy, spoke to the AI for Soldiers class on the future of AI on the battlefield, and engaged with participants during capstone presentations and feedback sessions.



Figure C-6. Capstone teams present their projects on Day 5 of the AI for Soldiers course.



Figure C-7. Participants receiving the challenge coin and certificate of completion from ARL Director, Dr. Patrick Baker, for the AI for Soldiers course.

AI for Soldiers cohort 2025



Figure C-8. AI for Soldiers 2025 participants along with instructors and ARL Director.

Appendix D. AI for Soldiers Certificate

This appendix appears in its original form, without editorial change.

SAMPLE

ARTIFICIAL INTELLIGENCE FOR SOLDIERS

This Certificate of Completion is Awarded to

PARTICIPANT

[Participant's Full Name] has successfully completed the 40-hour Artificial Intelligence for Soldiers course. The course, offered by DEVCOM Army Research Laboratory and the Futures and Concepts Center, provides Soldiers with knowledge of foundational artificial intelligence (AI) concepts and future AI capabilities for the Army. Participants gain insights into AI technologies, enabling them to provide senior leaders with data-driven decision-making abilities to solve business, strategic, or logistical problems within military contexts.

April 7-11, 2025

MG Stephanie R. Ahern
Director of Strategy, Plans, and Policy
Headquarters, Department of the Army

Course Date

Dr. Patrick J. Baker
Director
Army Research Laboratory



COL Michael P. Wagner
Director of Concepts
Futures and Concepts Center

Appendix E. AI for Soldiers Course Survey

This appendix appears in its original form, without editorial change.

AI for Soldiers Course Survey

AI for Soldiers
Course Survey

Hi, Mark. When you submit this form, the owner will see your name and email address.

* Required

Quantitative feedback

THIS COURSE NEEDS YOUR FEEDBACK! What do you think after going through the course? Click on some short disagree/agree/strongly agree statements and let us know from your perspective how this went - the comments section is your opportunity to be candid so please speak up!

1. How familiar were you with Artificial Intelligence coming into the course? (not at all, slightly familiar, moderately familiar, very familiar, extremely familiar) *

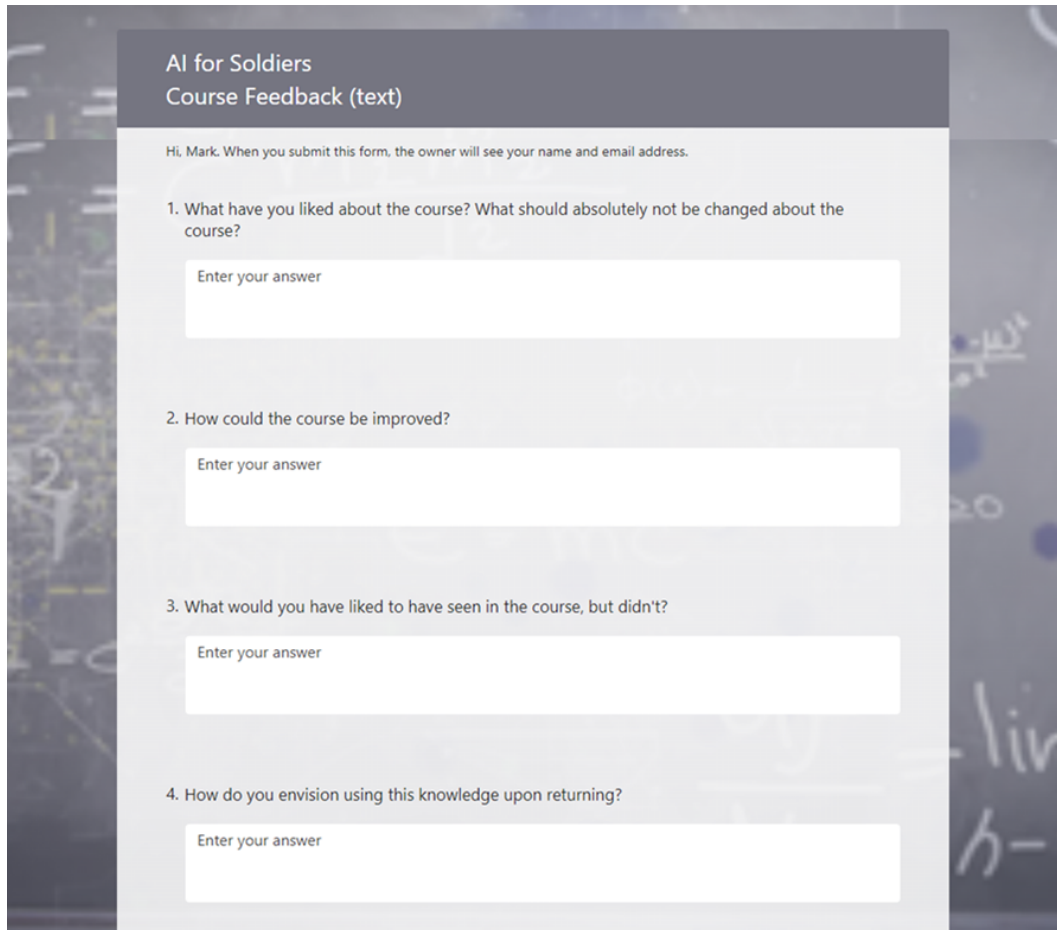
	Not at all	Slightly	Somewhat	Very	Extremely
How familiar are you with machine learning?	☐	☐	☐	☐	☐

2. Statements about the course. Please answer your agreement (or disagreement) with the statements below, i.e., strongly disagree, disagree, neither, agree, strongly agree (1-5 scale). *

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The presentations and course materials were well organized	☐	☐	☐	☐	☐
The presentations and course materials explained the course concepts effectively	☐	☐	☐	☐	☐

Figure E-1. AI for Soldiers course survey for gathering quantitative feedback from participants.

AI for Soldiers Course Survey

A screenshot of a web-based survey form titled "AI for Soldiers Course Feedback (text)". The form is set against a background of a chalkboard with faint mathematical equations. It includes a header section, a greeting, a privacy notice, and four numbered questions, each followed by a text input field.

AI for Soldiers
Course Feedback (text)

Hi, Mark. When you submit this form, the owner will see your name and email address.

1. What have you liked about the course? What should absolutely not be changed about the course?

Enter your answer

2. How could the course be improved?

Enter your answer

3. What would you have liked to have seen in the course, but didn't?

Enter your answer

4. How do you envision using this knowledge upon returning?

Enter your answer

Figure E-2. Screenshot of the AI for Soldiers course survey for gathering qualitative (long text) feedback from participants.

Appendix F. AI for Soldiers Course Feedback Comments

In the course surveys, there were multiple questions asking for feedback in the form of long text. For each of the questions, the question will be bolded and the participants' responses will be given.

What did you think of the course? Anything else that you wish to add?

1. "The modules in the first 2 days seemed heavy, and I was initially thinking the deep dive into math could have skipped. I thought all we needed was an appreciation of the concepts behind AI. I appreciate the math review now and am glad we got it, but would recommend instructors better explaining, up front, why this information is important.

We sort of just dove right into those modules with no context. MAJ Work helped provide some context, some 'so what,' and I think these modules would have been served with some scene setting to help the class understand why we're starting with such fundamental concepts and why that information is important. Most modules would have been better served with some context."

2. "I highly recommend that we implement a smaller-scale course at the Army school houses for our young leaders, who can take this information to their squads/platoons/companies and get real feedback on implementing tools or new uses for the tools. I think it would also inspire knowledge and excitement that we are investing in these leaders with emerging technology, that usually only is given to select units.

The instructors were fantastic. They brought interest into every concept and found a way to bring us back to the 'so what' of how learning the algorithms and math and concepts would better assist us in using AI/ML. I also enjoyed the guest speakers and field trips to Graces Quarters and the labs. I thought it was a good mix of classroom time and seeing the real products.

One week was sufficient for my learning and I feel comfortable in going back to my unit and explaining what I learned."

3. "I thought the course was very informative and provided me information regarding what AI does and doesn't do and how AI 'learns' and progresses."
4. "Acknowledging the budget restrictions, this course should certainly be 2 weeks. Additionally, it would be cool to collaborate with the Army Applica-

tions Lab (even remotely) to show how basic research manifests into applied research!”

5. “This course was able to form my understanding of AI/ML at the foundational level. Having the ability to briefly understand the models and functions, will help me justify required capabilities or concepts for its future use.”
6. “Very enlightening course that helped us build foundational knowledge about AI. Loved that I can tell how enthusiastic the instructors were and appreciated how patient they were with my questions and lack of knowledge about AI. This course motivated me to find opportunities to increase my competency in this field.”
7. “I would add small practical exercises to the course. if time was an issue, offer them as optional homework. Keeping the practical exercises under 1 h but adding an opportunity for feedback from an instructor the next day.”
8. “The course was very informative. It gave me a better understanding of how AI works and how to approach AI systems in the future.”
9. “The course was informative, and I would highly recommend others to take this course.”
10. “I loved it! I wish it was two weeks. I would have liked more “hands-on” with the material. Also, a little more in depth on what is currently out there and how they work, ChatGPT, DeepSeek, etc. I am sure there is much more available than we realize. Already thinking of ways how we can experiment here at the Training and Doctrine Command and working with the data team to see what is feasible and what is not. Being able to get Commerical (or privately owned computers onto the network) would be beneficial as well, so we can use the other tools, like ChatGPT, etc.”
11. “Thank you for providing such an in-depth exposure to AI/ML. I’ve never seen a course like this in the Army.”
12. “1. It would be good to provide resources to take online introductory classes for AI. 2. More breaks in between sessions. It felt like 2 h of lecture is a bit much without a break in between. It could be a quick 5–7 minutes to standup and stretch. 3. Use feedback to provide how service members could benefit

from AI in their daily positions. For each warfighting function, how can AI help them. 4. Share best practices of applied technique on a portal that people can reach.”

13. “I thought the course was very interesting. The instructors were very knowledgeable and passionate about the AI technology. The material was easy to digest even with no background on coding and AI. I think the course can be better if we had some practical exercises. Maybe assigning small homework each day.”
14. “Keep Reggie and Mark teaching! Having some more time at Graces Quarters where we get to see the robotics in action on the terrain would be awesome.”
15. “It was really great and already have many at my unit who are interested in attending the next one”
16. “As someone with essentially no experience using or building AI tools, I felt some of the course content was difficult to understand at the pace it was presented. I understand that time constrained the amount and type of content and the pacing, but I felt I had only barely grasped the differences between types of models and how each operates after the lecture concluded. It felt as though we were sprinting through the slides without ample time to take notes on and digest the displayed content. However, I found the subject matter fascinating and feel I’ve inched closer to understanding how various types of AI models function. I also enjoyed meeting the scientists working at ARL and having exposure to up-and-coming Army technology utilizing AI and machine learning elements.”
17. “The one-week AI/ML course was exceptionally well-organized. The curriculum provided an excellent overview of fundamental concepts and practical applications in artificial intelligence and machine learning. Overall, it was a valuable and insightful experience that significantly enhanced my understanding of the subject matter.

A key highlight was visiting ARL and engaging directly with the scientists. I recommend establishing an AI/ML Student Alumni network—like ‘S1NET’—where ARL leaders can connect with military, DoD civilian, and contractor personnel across the enterprise. Such a platform would enable the force to disseminate more efficient information, tools, and resources.

Thank you to everyone who contributed to the success of this course. Special thanks to MG Ahern—your leadership presence was truly invaluable. I also want to recognize the ARL team for their seamless coordination and support throughout the week.

Dr. Reginald Hobbs and Dr. Mark Tschopp delivered the content in a clear, digestible manner that made science and math approachable without being overwhelming. Their delivery greatly contributed to the effectiveness of the course.”

18. “Thank you! Course was excellent”
19. “Great course! Highly recommend for ALL ranks, grades, and military occupational specialties.”
20. “There is a lot of in depth information presented in the course, for this reason I think that there should be at least 5 minutes breaks on the hour at a minimum.”

Please describe your background and describe how familiar you were with AI and machine learning before participating in this course? What motivated you to take this course, and what did you hope to learn?

1. “As an acquisition officer at PEO C3N, we talk to technologists and explore future concepts on a daily basis. I’m constantly talking to members of industry who are way smarter than me and I wanted to learn enough to ask the right questions, and to be able to spot nonsense. I also would like to be able to spot opportunities for AI innovation within the capabilities I will be responsible for developing and fielding in the future.”
2. “I currently work in the G3 within the Expeditionary Sustainment Command. My daily operations are planning command and control exercises. I was not familiar with AI and ML at all. Before this course, I viewed using AI/ML as lazy. Why not be creative/brainstorm with co-workers/think about solutions, instead of doing a search and using whatever answer it provided.”
3. “I have an operational background in the Army. I’m a CBRN officer by trade, currently in a Battalion Executive Officer position at a Basic Training unit. I was unfamiliar with AI and had no idea what machine learning was before

I took this course. I took this course to gain an understand of what each of those topics are.”

4. “AH-64D/E Apache Maintenance Test Pilot/Examiner; My familiarity with AI started when ChatGPT was launcher November of 2022, then deepened when I attended the pilot AI for Soldiers course. As a result, I’ll be focusing on AI implementation for the Army Aviation Enterprise, coupled with a follow-on AI course at Massachusetts Institute of Technology after my Masters in Business and Administration.”
5. “Through my thesis at the Naval Postgraduate School, I had some exposure to AI/ML concepts. I also did a short internship with the DIU AI/ML portfolio team. I wanted to take this course to gain an understanding of the foundational concepts of AI and see how the Army is trying to educate the force about this field.”
6. “I recently graduated with a master’s in information systems. I didn’t give myself enough credit in knowledge about AI before the program. I assumed I didn’t know much about AI. I wanted to gain insight and confidence in the use and knowledge of AI. The course is a great foundation and was very fulfilling. I feel confident I can use methods taught in the course to help me and my peers at my work to improve speed and accuracy in some areas of work.”
7. “I heard about ChatGPT and NIPR-GPT but never used them or really intended on using them. I wanted to know more about AI and how to best approach it and use it.”
8. “I am an Military Police Staff Officer with beginner experience in AI/ML. I was eager to take the course to gain a better understanding of AI/ML and its use in the military.”
9. “CBRN Warrant Officer for the 18th Airborne Corps. I was ‘somewhat’ familiar with AI and machine learning, just based off of own research. I wanted to really know the backing behind it all, as a technical person, I like to know how things work and how to improve them. I learned a lot more than I expected, already diving into the Massachusetts Institute of Technology [Deep Learning] YouTube videos and looking into other courses as well on-line.”

10. "Coming into the course I had topical exposure to AI/ML and some regulatory research experience. I also had prior exposure to data analysis and quantitative inference, which I think helped in understanding the mathematical components of the course. I took this course as an employee of FCC. While the AI for Soldiers course is reputable, I did not come in with any expectations."
11. "I am a Chief of Operations at a Sustainment Command. I have used systems such as NIPR-GPT as well as AskSage. I was motivated to take this course because I see AI and machine learning as the way of the future, especially when looking at designing 2040 and beyond."
12. "I was fairly familiar with the topics from a civilian private sector use perspective but I was not well educated on the underlying math or computer science that drives the technology."
13. "I am a member of the 95th Civil Affairs Brigade Civil Knowledge Center, where we aggregate and analyze Civil Affairs teams' reports to create a common operating picture that ultimately informs commander decision-making. I was not at all familiar with AI before entering the course, and had not even queried accessible options like ChatGPT. I was, and still am, boycotting image-generating AI due to it undermining the market for human artists and its usage of human-created art as its dataset. I felt I was being too resistant to emerging technologies and wanted to welcome the value of AI tools that will very soon be fielded in my section. My team leadership asked that I become the team's expert in querying AI systems by taking this course, so that was also an extrinsic expectation."
14. "Very little understanding of how AI actually worked before this class. I had deep experience with statistics and regression models. I wanted to demystify how AI actually works so I can better understand its capabilities"
15. "Active Duty Air Defense Artillery Officer currently serving has an U.S. Army Human Resources Command Career Manager (Air Defense Artillery branch). I have served in most Air Defense echelons and across multiple weapon systems CONUS and OCONUS. My assignment before becoming a Career Manager was Battery Command in Germany. I have a bachelor's in Criminal Justice and master's in Cybersecurity. While I had some theoretical exposure to

AI/ML concepts from my academic background and following trends in recent media, I had little to no hands-on experience or formal training. Most of my experience derives from commercial platforms hosting AI/ML for personal projects and general experimentation of what is possible with current capabilities. This course was my first structured deep dive into the AI/ML space from a military operational and strategic lens.”

16. “I am an Army Futures Command Concept Developer working to incorporate future technological developments in future Army concepts. I have a background in intelligence analysis. I attended the course to get a better idea of the state of AI development and its potential use in Army applications over the next 5–15 years.”

What have you liked about the course? What should absolutely not be changed about the course? What were the things that impressed/interested you the most and what did you find the most helpful for your role in the Army?

1. “I really liked seeing how ARL is applying AI research to real world problems. I enjoyed the day at R2C2, really appreciating the areas where researchers are challenged and how they’re progressing the field. I enjoyed getting a greater appreciation for the hard problems, where AI isn’t necessarily the pixie dust.”
2. “I really enjoyed the instructors and the mix of classroom and field trips to see the applications of the math we learned. Do not change the material. I felt it followed a logical path, going from the very start to ending with robotics. I was really impressed with meeting the researchers and scientist who had a depth of knowledge on Army operations. I felt they all had a good grasp on what Soldiers needed and issues they might have in implementing emerging technologies.”
3. “I liked the practical application days of the course and that should absolutely not be changed. For my role in the army, understanding the data input requirements for effective use of AI was very helpful.”
4. “I appreciate the ‘look behind the curtain’ that the ARL provides to those who otherwise are unaware of its existence, relevance, or scope. What shouldn’t

be changed is the course's availability. This course was pivotal for me in my career desires as well as enhancing exposure and awareness for the course attendees. This course provided a foundation that enabled my pursuit of bringing AI to Army Aviation, and have now been trusted by PEO-Aviation to do that."

5. "I really enjoyed the fact that I was able to ask all sorts of questions in class. Although the math/logic portions of the course were a bit challenging, I thought they were fascinating. I really like the lab tours on Day 4 (do not take this out)."
6. "I think the meals, lodging and office environment were great. It was well set up, the instructors, support staff and guest speakers were fantastic. I wouldn't change the model from this 1-week platform. I think it went well."
7. "I liked understanding how AI works and the real-world examples that was provided. The instructors gave us the background knowledge and then showed us times where it failed and where they had success."
8. "I appreciated having expert professionals teach the course and would recommend keeping the same instructors, including military personnel, for future sessions. I found the demonstrations from RC2C and the lab tours particularly engaging, as they provided valuable insights into current initiatives and the future direction of AI/ML in the military."
9. "The instructors were very knowledgeable and the interaction between the students. I wouldn't change the material, just add to. Impressed by the material itself, there were things that I didn't know about, especially with LLMs and what they can actually accomplish and how the Army was conducting research with the models. The robotics piece was very interesting as I have worked with DEVCOM in the past, but they never mentioned anything about robotics and AI."
10. "I liked the foundational mathematical concepts and exposure this course provided for Soldiers, and I would not change this in the slightest. I also think the course did a great job at keeping the topics grounded, curbing fear mongering/hypothetical/and what if discussions. I was really impressed with the pedagogy and overall professionalism of the course. I appreciate Soldiers being

in civilian professional attire, creating a more level-setting and exploratory learning environment for all students. An aspect of the course I found most helpful to my role in the Army is improving my skills in science communication, and knowing how to tailor future questions/inquiries on AI/ML.”

11. “Although the math was rough, it was important to understand the foundation of AI and how it works. Understanding the capabilities of AI was a key takeaway for me.”
12. “I think that having the research perspective was important. We see lots of industry hype cycles around this topic so an objective research-based perspective was great. I also think the depth was great and covered all the necessary pieces for understanding the topic.”
13. “As someone unfamiliar with the abilities of different AI model types, I liked learning about the different approaches to AI and machine learning that decide its capabilities and strengths. I particularly enjoyed learning how natural language processing works at the intersection of linguistics and computer science. I also believe that understanding how AI understands language will help me write queries more thoughtfully, which was an intent of my team leadership.”
14. “The way the course continued to build upon itself was excellent. Math was introduced really well and plenty of visual resources and good examples to reinforce the learning.”
15. “The pace and content was great! Building the foundation instead of sensationalizing ChatGPT was critical. I have no recommendations for course changes. I was most interested in applied AI/ML such as the lab tours and robotics.”
16. “The in depth explanations of different types of AI and ML, and descriptions of how they are trained, strengths and weaknesses.”

How could the course be improved? What would you have liked to have seen in the course, but didn’t?

1. “I would have appreciated some more scaffolding around the instruction. Some framing of the material and why it’s important. In some modules, I

was open to the material, but it took me a minute to understand why it was important. Sometimes MAJ Work had to step in and explain why something mattered, I think that context would have been helpful up front as we dive into the modules.”

2. “I would have enjoyed more hands-on time to experiment with the applications and using AI/ML to solve military problems/questions.”
3. “If the course remains a 1 week course, I think that it needs to be more application focused with a broader (more wave top) overview of the math involved.”
4. “The course HAS to be longer than a week and provided more frequently throughout the year. Possibly a remote course that could reach a broader audience.”
5. “It would’ve been great to have a more robust read-ahead that provided an overview of the AI research community/ecosystem, strategy, and implementation. I know that people are busy with their day jobs, but I think a read-ahead can provide references and information that we aren’t able to cover in-person. Also, recommend having one guest speaker who can talk about the application/fielding of AI into the Army (above TRL 5). Although most of the focus is on the basic research side, it would be cool to get the perspective of someone who is working to take the basic research and prototyping/testing it for the current operational environment.”
6. “I think adding a small practice exercise, maybe 2–3 through the week. This will add practical use based on the information taught. Maybe a practice exercise of how to use NIPR-GPT or AskSage for some common tasks for leadership roles. This could be optional as homework if time is not possible. Then students can double-check with instructors the next day for support.”
7. “I think adding practical exercises on the different AI systems would be great. So that we are not only learning about the systems that are used, but we can do it in real time using AskSage or NIPR-GPT. We briefly did a practical exercise with the glove test excels.”
8. “I recommend expanding the course to accommodate more participants for broader dissemination of the content.”

9. “Two weeks—and possibly either a follow on course or break it into 2 weeks with 1 week as the primer, then give the students something to study or look into until the next course. I think you might find that the students will come back with some pretty interesting stuff in that second week. Maybe like 6 months apart and give them a ‘project’ to work on.”
10. “It would be great if we had a beginning of the course assessment and the end of the course assessment to see how we improved in our understanding of course material. I would also love to see guidance for continued learning, anywhere from recommended foundational math courses to techniques in science communication.”
11. “I think having a couple of sessions where we learn how to make prompts for NIPR-GPT would be beneficial.”
12. “I think coming up with military examples for all of the problems discussed, instead of dog and cat categorization it could be tank vs car. I also think that some hands on problems to gain more experience with the problem set. We dont need to be able to come away building our own AIs but hands on examples that truly show where the technology WILL be useful and where it WILL NOT be useful in the future.”
13. “Unrelated to course content, I paid for 2 days of catered lunch (lasagna, pizza) but found it a bit underwhelming. The lasagna day was described as a ‘buffet,’ but somehow \$15 per person only purchased a single tray of very standard lasagna, and the administrators setting up the serving table began cutting pieces in half, afraid they would not have enough to serve everyone. A ‘buffet’ would imply that everyone could eat as much as they wanted. But in reality, those who arrived after they decided to cut pieces in half may have been shorted even a full single portion. \$10–\$15 per day was sufficient for me to purchase a generous amount of food from the cafeteria with a fairly short wait for preparation, so it was a more cost-effective option than prepaid lunch.

In my quantitative feedback, I mentioned that we sped through some presentations at breakneck pace without ample time to digest the presented information. Perhaps slides could be revised to provide some summary of the overarching point (for example, what a model’s individual time or space complex-

ity means in an application context compared to others rather than describing each of their differences subjectively and in isolation). Attempting to take notes and also comprehend the implications of some information was difficult at the lecture's current pace. I understand it is extremely hard to simplify these concepts and it does them a disservice to be 'dumbed down' to broad strokes, and that time is constantly a constraint, but I was able to retain very little with such little time spent on each slide.

When we split the group in half between the 2 teams of scientists on Thursday, the room containing the VR headsets I felt did not have a well-displayed and organized presentation for their work, and I am still a bit fuzzy on their focus.

Less importantly, I thought we would get to see a demo of the self-driving DARPA vehicles since they were running the entire time we were learning about them but was disappointed that we didn't."

14. "Physical printouts/some sort of repository for the math proofs involved. Maybe even like a master reference book or 1–2 pager to compliment the slides. Being able to see the math as it builds on itself may be helpful for others.

I love math and would have enjoyed working through some very basic problem sets as we went along the first few days."

15. "Would have loved to see the Polaris RZR drive on its own—only kidding! Understanding the constraints of the course, I believe I was positively overwhelmed with the content of the course."
16. "For the tech demonstrations I would have preferred more in depth interaction with some of the systems under development. Specifically, the ability to see the unmanned vehicles navigate over difficult terrain to better understand their limitations and how troubleshooting the systems take place. It would be better to see less tech get demonstrated, if student had a more in depth demonstration or even interaction with the tech."

How do you envision using this knowledge upon returning? After completing this course, how do you plan on using what you learned to further the Army mission?

1. “This summer I will PCS to DIU and I hope to work on AI projects there. I have a much greater appreciation for how these tools work, the potential for solutions, and the limitations of tools. I feel much better equipped to approach these projects now and have a great basis on which to build.”
2. “I envision spending more time with the AI/ML applications that I have access to: PowerBI, MAVEN, NIPR-GPT, AskSage. I also plan to provide an LPD to my coworkers, so they can understand how to utilize AI as a tool with human oversight, and what emerging technology is being worked. I’m excited to stay tied into the Army Futures Command and read on what they are working on.

This class also gave me a spark of excitement about the Army of the future and what will be different, how we must change to become more lethal, and how to do better with what we already have.”

3. “I want to try to incorporate AI into my daily use to help me use my time more efficiently so I can spend my time doing other things.”
4. “Improving Army Aviation business processes, data pipeline management, and connecting both lateral and vertical digital communications among warfighting functions that directly affect the aviation mission.”
5. “I plan to help educate other leaders in my organization about the limitation and opportunities of using AI. I think this knowledge is so important given the constant inundation of vendors who keep wanting to sell us their products. We also need to understand how AI is going to affect the information environment in the future.”
6. “The course is a great foundation and was very fulfilling. I feel confident I can use methods taught in the course to help me and my peers at my work to improve speed and accuracy in some areas of work. My first plan after this course is filtering through large amounts of unstructured data to categorize and organize. To later improve our methods of processes and actions within my office.”
7. “I intend to use what I learned to spread the word on the many different AI systems and how to approach them. I think people assume AI knows all, but it is important to understand its limitations, so you know how best to use it.”

8. "I will brief my unit on the course content and share available AI/ML software for military members."
9. "I am already working with the DEVCOM team to try and implement ETI, as well as the DEVCOM team on the Chem/Bio side to see how we can improve some of the CBRN sensors integration through AI. I see building on what we have learned already and breaking into some great experimentation efforts at the Training and Doctrine Command and at the schoolhouses to see what AI can provide for the Warfighting Functions, especially as we look into 2030/2040 and the Human–Machine Integrated Formations (HMIFs)."
10. "I plan on being more involved with information management projects in my professional capacity."
11. "I plan to help my subordinate commanders and those I work with to better frame problems. Data is beneficial, but understanding the problem set goes a long way to solving it."
12. "Yes very much. I think that understanding how to collect the right data the right way is the biggest take away to allow our unit to properly use this technology in the future."
13. "I envision myself able to provide context for what our incoming AI tools will or will not be capable of depending on their underlying models. I also anticipate a better ability to write effective queries when requesting complicated or nuanced sets of data."
14. "This course will help me inform the drafting of the Army concept and identify emergent capabilities for future employment"
15. "Several ideas—Human Resources-related career progression models as well as being that translator when vendor X is selling cutting edge tech for Air Defense. I will also use the opportunity to identify when a process or procedure could leverage AI/ML/Automation to increase the speed of decision-making, lethality, and out-pacing our enemies."
16. "The course gave me a better familiarity with AI concepts, to better guide how I research for information on AI and associated technologies for inclusion in future Army concepts and experimentation. The course also gave me a better understanding of the Army AI portfolio and research POCs."

To better understand the long-term effects of the AI Strategic Broadening Seminar, we reached out to several participants from the 2024 cohort nearly a year after the course concluded. We asked them to reflect on how the experience may have influenced their thinking or actions—whether it inspired further learning, shifted how they engage with vendors, encouraged advocacy for better data practices, sparked the use of tools like ChatGPT, or even shaped career trajectories. While this course was likely not their only exposure to artificial intelligence, their perspectives help illuminate its unique value within the broader context of Army education and modernization efforts.

What was the impact or outcome of participating in this course? In what ways—large or small—did it shape your work, thinking, or engagement with AI?

1. “The HQDA Artificial Intelligence Strategic Broadening Seminar (SBS) provided a transformative foundation for understanding how to frame complex AI problem statements and identify practical AI use cases within the Army. Through exposure to advanced AI concepts and interdisciplinary collaboration at ARL, participants gained essential insights into neural networks, capabilities and limitations of machine learning models, developing organizational trust, and discovering approaches to lateral and vertical AI integration at each echelon of Army enterprise operations. This experience catalyzed my intrapreneurial desire to vertically and laterally integrate AI into Army Aviation processes. Personally, the AI SBS inspired a strategic mindset shift toward brainstorming creative ways to actively leverage artificial intelligence to optimize data management, decision-making, sustainment analytics, domain knowledge continuity, and improvement of warfighting function workflow efficacy through agentic or other means. By demonstrating the value of targeted AI applications for multi-domain operational efficiency, the seminar established a clear pathway for developing and implementing innovative AI-driven solutions while fostering a proactive culture of technological adoption within the strategic alignment of Army Aviation and the Army Enterprise.”
2. “In short, the course was great. I immediately saw ways to integrate machine learning and AI into my current workflows. Understanding how these systems work—and where they are most likely to fail—helped me build in appropriate checks. I began using tools like NIPR-GPT and CamoGPT to assist with

document creation and data analysis. These tools were excellent for quickly writing formulas and identifying trends—far more efficient and direct than using a traditional search engine. The course gave me a much clearer picture of how the Army is pursuing AI integration, especially in ways I hadn't been aware of before.”

List of Symbols, Abbreviations, and Acronyms

AI	artificial intelligence
AI4S	Artificial Intelligence for Soldiers
ARL	Army Research Laboratory
CBRN	chemical, biological, radiological, or nuclear
CIV	Civilian
CONUS	Continental United States
DARPA	Defense Advanced Research Projects Agency
DEVCOM	U.S. Army Combat Capabilities Development Command
DIU	Defense Innovation Unit
DoD	Department of Defense
ETI	Enhanced Tactical Inferencing
FCC	Futures and Concepts Center
GPT	generative pre-trained transformer
HQDA	Headquarters, Department of the Army
HMIF	Human–Machine Integrated Formation
LLM	large language model
LPD	leader professional development
ML	machine learning
NCO	Noncommissioned Officer
NIPR	Non-classified Internet Protocol Router
NLP	natural language processing

O	Officer
OCONUS	Outside the Continental United States
PCS	Permanent Change of Station
PEO	Program Executive Office
POC	point of contact
R2C2	Robotics Research Collaboration Campus
RZR	Polaris RZR (“Razor”) Utility Terrain Vehicle
SBS	Strategic Broadening Seminar
TRL	Technology Readiness Level
VR	virtual reality
WO	Warrant Officer

1 DEFENSE TECHNICAL
(PDF) INFORMATION CTR
DTIC OCA

1 DEVCOM ARL
(PDF) FCDD RLB CI
TECH LIB