AI Policy and Strategy Skills Course

Computational Applications to Strategy and Policy (CAPS)*

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The CAPS AI Policy and Strategy skills course is an immersive six-part seminar that trains participants in the role of a fictional Forward Deployed Policy Engineer tasked with overseeing AI systems deployed in an ongoing conflict zone. It begins with an AI bootcamp and quickly moves participants "into the field" to confront case studies rooted in real needs in the test environment of Afghanistan.

The Job

A Forward Deployed Policy Engineer (FDPE) assesses and aligns levels of autonomy in decisionmaking processes where decisions are made by human actors and autonomous agents situated in strategic environments. Specifically, the FDPE coordinates multiple stakeholders across the development and deployment of autonomous agents. The FDPE-guided coordination reduces trade-offs in the performance of autonomous agents resulting from misaligned information demand and supply of the agents' human stakeholders. The FDPE operates in domains that have an opaque problem space and defy precise solutions. The solutions provided by the FDPE are often approximate and focused on defining the problem space in a manner sufficient to enable domain experts, such as engineers or policy makers, to build complementary solutions that align to solve a problem. Hence, the FDPE often pre-solves problems rather than solving problems end-to-end. The portfolio of solutions provided by the FDPE ranges from assessing software architectures to designing software architectures to drafting policy recommendations. These tasks are carried out in time-constrained, highly dynamic environments in which the necessary data is distributed across multiple heterogenous stakeholders.

The Environment

FDPEs are needed in a range of environments that contain autonomous agents, from trading firms to combat theaters. Here, the environment is an advice and assist mission in Afghanistan, Operation Guided Transition, and encompasses military and civilian engagements. As a FDPE embedded with the Afghan National Army (ANA) and a Coalition Train Advise and Assist Command, you are focused on coordinating engineers, operators on the ground and senior policy makers to ensure that autonomous decision-making contributes effectively to the mission and remains in accordance with the mission's ethics.[1] The Afghanistan of Operation Guided Transition presents a challenging environment. The distributed threat landscape and limited number of Coalition forces provide strategic need for the use of autonomous decision-making; a need augmented by experience with the deployment of unmanned aerial vehicles (UAVs). However, the complex structure of the human terrain, from the configuration of the ANA's personnel to the tribal networks of the population to the loose organizational structure of the adversary, imposes clear operational constraints on the use of autonomous decision making.

*Written using XeLaTeX.

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[1]These ethics exlude the use in any form of lethal autonomous weapons systems

The Training

To succeed as a FDPE, you will be trained in two areas:

- Formalizing human decision-making to enable its interoperability with machines
- Normalizing machine decision-making to enable its interoperability with humans

As part of this training, you will learn to:

- Differentiate levels of autonomous decision making based on latent performance factors
- Navigate core algorithmic learning architectures, such as reinforcement learning
- Transform the specifications of a learning algorithm into decision-relevant intelligence
- Infer a system's underlying specifications from its observed behavior
- Find misspecifications in a software architecture based on fuzzy end-user feedback
- Identify performance-relevant links in complex human-machine ecosystems
- Communicate technical topics to senior policy makers and policies to engineers

Much of this learning will take place on the ground throughout your deployment.

The Structure

CAPS consists of six lectures. In the last lecture, students present a short report of recommendations on autonomous decision making in Operation Guided Transition to a senior policymaker, with details TBA.

The course has lecture notes, which will be made available on GitHub along with other course materials. Links to the GitHub repository will be made available before the start of the first lecture.

The goal of the lectures is to provide students with a technically-grounded, conceptually robust understanding of relevant algorithmic learning architectures and the trade-offs arising from their implementation in a complex, multi-stakeholder world.

Lecture 1 - Introduction to Human Factors and Reinforcement Learning

- Guiding question: How do human teams make decisions and how does this decision-making compare to autonomous decision processes, such as those of reinforcement learning algorithms?
- Topics covered: Learning from interaction; Decision-making in human teams; Reinforcement learning; Markov decision processes; Bellman equation
- Case: Learning in a counterinsurgency team

Lecture 2 – Rule-Based Decision Making in a Fuzzy World

- Question: How can we transform fuzzy descriptions of specialized human performances into computable knowledge for an autonomous system to act on?
- Topics covered: Rule-based systems; Finite-state machines; Basic search algorithms; State space complexity; System requirements in fuzzy environments
- Case: Designing and evaluating a rule-based system to clear a conflict zone

Lesson 3 – Learning to Make Decisions with and without a Model of the World

- Question: How can we conceptualize core differences in learning architectures and apply this knowledge to augment partial observations of a reinforcement learner's performance?
- Topics covered: Q-learning; Value iteration; Basic inverse reinforcement learning; Black box problems
- Case: Determining and evaluating possible learning architectures of an enemy drone

Lesson 4 – Guiding Reinforcement Learners through Human Control

- Question: How can we use human input throughout the reinforcement learning process and during deployment to ensure optimal system performance and what are the trade-offs of this approach?
- Topics covered: Human-in the-loop reinforcement learning; Shared autonomy; Reward shaping
- Case: Improving the operation of a semi-autonomous supply convoy in a contested environment.

Lesson 5 – Making Sound Long-Term Predictions about AI

- Question: How can we synthesize partial observations into stable predictions about the longterm development of AI and its impact on operational ecosystems?
- Topics covered: Methods of analysis and prediction
- Case: Developing recommendations on implementing autonomous decision-making into a counterinsurgency campaign

Lesson 6 – Participant Presentation and Debriefing with Senior Policymaker

- Question: How can we provide meaningful insights into a complex, technical domain for a senior policymaker to determine high-level strategy
- Details for guest senior policymaker TBA.

Time and Location

CAPS takes place over three weeks, with two 90 minute sessions per week. The first session will be on Wednesday, April 3.

- Wednesdays 6:00–7:30 pm in Nitze 507
- Fridays 6:00–7:30 pm in BOB 736

Skills Course Policy

CAPS is pre-approved as an official SAIS skills course, meaning that if you attend all of the sessions, you obtain certification for the course on your transcript.

We will announce the skills course approval and our faculty sponsor soon.

For the course to appear on one's trascript, they must attend all sessions.

Contact

Please contact the CAPS team at capsseminar@gmail.com for any questions and to register for the seminar.