ILLINOIS
CSL | Coordinated Science Lab
COLLEGE OF ENGINEERING

Impact of AI: What to expect in the Next Decade?

Panel at CSL Student Conference 2020

Moderator: Klara Nahrstedt, Director of CSL

Impact of AI – Why is it Important?

- **Current Advances of AI**
  - Machine learning, robotics, computer vision, natural language processing, inference, decision-making and planning
- **Impact of AI in Current applications**
  - Navigation systems, web search, speech recognition, machine translation, face recognition and recommender systems
- **Impact of AI in Upcoming applications**:
  - Semi-autonomous and autonomous ground and air vehicles, systems that harness planning and scheduling, intelligent tutoring, robotics.

20 Years National AI Roadmap (CRA/AAAI)

- **Societal Benefits**
  - Boost health and quality of life
  - Provide lifelong education and training
  - Reinvent business innovation and competitiveness
  - Accelerate scientific discovery and technical innovation
  - Expand evidence-driven social opportunity and policy
  - Transform national defense and security

- **Need fundamental research advances in key areas of AI !**

CRA – Computing Research Association; AAAI – Association for the Advancement of Artificial Intelligence

Major Research Priorities (CRA/AAAI Roadmap)

- **Integrated intelligence**
  - Develop science of integrated intelligence
  - Develop contextualized AI to suit specific uses
  - Create open shared repositories of machine understandable world knowledge
  - Understand human intelligence to inspire novel AI and develop models of human cognition
- **Meaningful interaction**
  - Comprise techniques for productive collaboration in mixed teams of human and machines
  - Combine diverse communication modalities
  - Provide privacy, responsible and trustworthy behaviors
  - Fruitful online and real-world interaction among humans and AI systems

Major Research Priorities (CRA/AAAI Roadmap)

- **Self-aware learning**
  - Quantify uncertainty and durability,
  - Learn from small amounts of data and through instruction,
  - Incorporate prior knowledge into learning
  - Develop causal and steerable models from numerical data and observations
  - Learn real-time behaviors for intentional sensing and acting

- **Reference**: Y. Gil, B. Selman, "A 20 –Year Community Roadmap for Artificial Intelligence Research in the USA", 2018, https://cra.org/ccc/visioning/visioning-activities/2018-activities/artificial-intelligence-roadmap/

AI Research Priorities will need Advances in

- **Computer Systems and Hardware**
  - Development of methods for speeding up core computational procedures employed by AI systems (training and classification methods)
  - New approaches to parallelism, smart caching, use of specialized hardware (FPGA, Loihi)
- **Theoretical computer science**
  - Combinatorial challenges, computational complexity theory, studies of computability

Future Advances (2)

- **Cybersecurity**
  - Understanding new attack surfaces; understanding and hardening against machine learning attacks
- **Formal Methods**
  - Define and constrain AI systems – ensure that their behavior conforms to specification
  - Enable real-time verification of AI programs through new kinds of monitoring
- **Programming languages, tools and environments**
  - Higher level languages for new kinds of abstractions to enable vision, speech recognition, NLP for multiple AI analytical pipelines

Future Advances (3)

- **Human-Computer interaction**
  - Explain-ability of AI systems to people
  - Ability of people to work interactively with AI systems (e.g., interactive machine learning) that help with
    - specifications, encoding, understanding of implications of different policies, values, preferences assumed by automated systems
  - Support of AI-human collaboration including mixed initiative interaction and augmented human cognition
- **Reference:** G. Hager et al., Advances in Artificial Intelligence Require Progress Across all of Computer Science, CCC (Computing Community Consortium) White Paper, February 2017 (https://arxiv.org/abs/1707.04352)

Panel Organization

- The moderator introduces the topic and panelists.
- Each panelist presents his/her position to “Impact of AI in Next Decade” (5 minutes)
- We open the discussion to the audience for Q & A.
- Moderator injects questions if needed.

Panelists

Ellick Chan

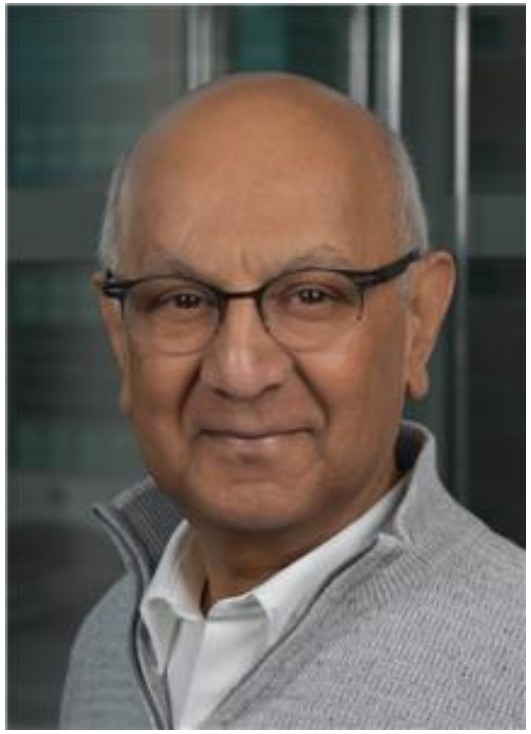
- Lead of University Relations and research – Intel AI Academy at Intel Corporation
- Adjunct Faculty at Northwestern University
- Research Interests: operating systems and security, advanced AI technology, optimization of AI Systems

Saurabh Gupta

- Assistant Professor in the Department of Electrical and Computer Engineering at UIUC
- Member of Coordinated Science Laboratory
- Research Interests: computer vision, robotics and machine learning; investigating the interplay between action and perception

Ravi Iyer

- George and Ann Fisher Distinguished Professor of Engineering in the Department of Electrical and Computer Engineering at UIUC
- Member of Coordinated Science Laboratory, the National Center for Supercomputing Applications, the Carle Illinois College of Medicine, and the Carl R. Woese Institute for Genomic Biology
- Director of Illinois/Mayo NSF Center for Computational Biotechnology and Genomic Medicine (CCBGM)
- Research Interests: Computational Genomics, AI Analytics Framework for Health-Care



Bo Li

- Assistant Professor in the Department of Computer Science at UIUC
- Research Interests: machine learning, security, privacy, and game theory; exploring vulnerabilities of machine learning systems to various adversarial attacks, and endeavors to develop real-world robust learning systems.

Alex Schwing

- Assistant Professor in the Department of Electrical and Computer Engineering at UIUC
- Member of Coordinated Science Laboratory
- Research Interests: algorithms for prediction with and learning of non-linear (deep nets), multivariate and structured distributions, and their application in numerous tasks, e.g., for 3D scene understanding from a single image.