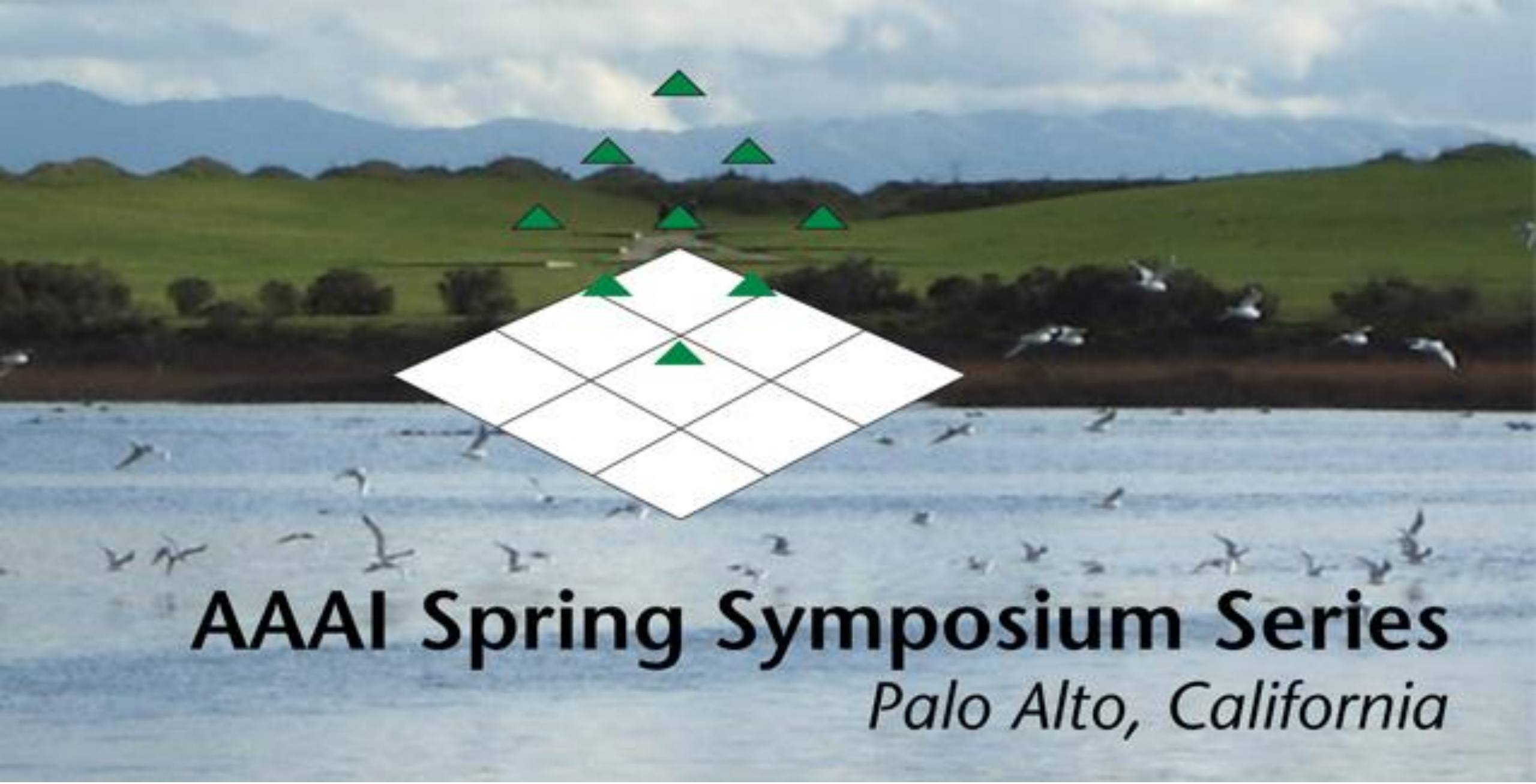


AI WELCOMES SYSTEMS ENGINEERING: TOWARDS THE SCIENCE OF INTERDEPENDENCE FOR AUTONOMOUS HUMAN-MACHINE TEAMS

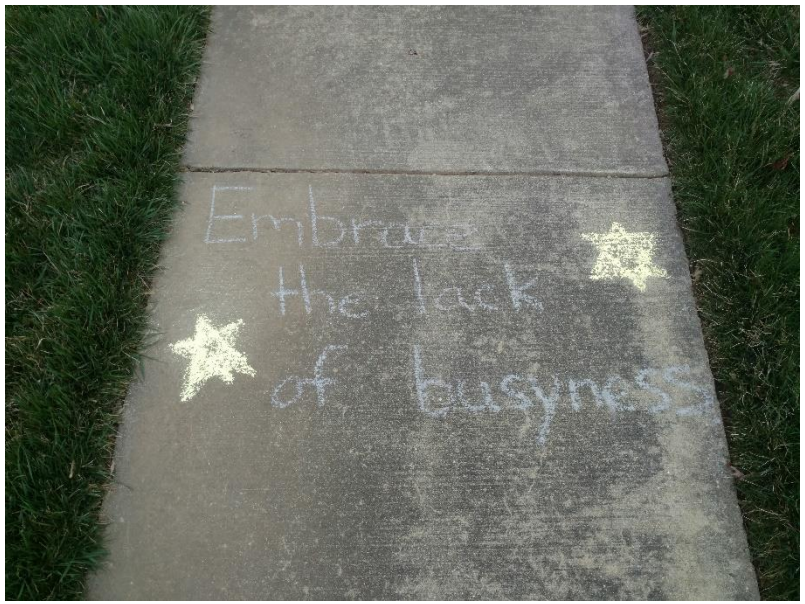


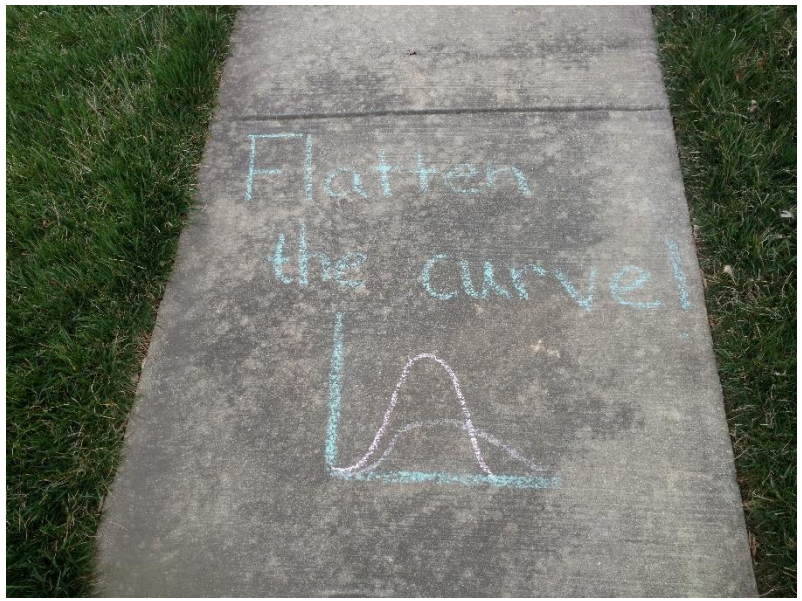

Unfortunately, we cannot be here……

Take care of yourself, family and friends

Thank YOU for the virtual participation!

…..because we must do this!





NRL is on mandatory telework!

If you can’t get into the Lab….

…bring the Lab home

U.S. NAVAL RESEARCH LABORATORY

NRL's Mission Statement

- Department of the Navy's full-spectrum corporate laboratory. Conduct a broadly based multidisciplinary program of scientific research and advanced technological development directed toward maritime applications of new and improved materials, techniques, equipment, systems and ocean, atmospheric, and space sciences and related technologies.

- Notes for emphasis:
  - ❑ Performance across entire spectrum of classification levels
  - ❑ Deep U.S. Government personnel technical base
  - ❑ Integrated with Naval Research Enterprise and NR&DE (Systems Centers / Warfare Centers)
  - ❑ Strengthening warfighter connections while maintaining strong connections with scientific communities

U.S. NAVAL RESEARCH LABORATORY

More than 2,700 world-class personnel

1,790 Science and Engineering (S&E) Professionals

418 electrical engineers
334 physicists
152 engineers (other)
160 computer scientists
109 mechanical engineers
89 chemists
81 aerospace engineers
57 oceanographers
53 meteorologists
46 physical scientists
34 mathematicians
30 biology/microbiology
29 astronomers
4 metallurgists
39 others (geology, psychology, health physics, etc.)

- 896 PhDs
- ~ 160 Professional Society Fellows
- 44.9 average employee age
- ~ 175 Postdocs and summer faculty

799 Support Professionals

430 specialists, analysts
249 admin support
120 S&E technicians

Small military contingent

20 at NRL-DC
67 at VXS-1 squadron
Others across NRL

U.S. NAVAL RESEARCH LABORATORY

Why consider the interdependence of AI and SE?

- Current state of deep learning – where it works well, where it doesn't
  - Lots of data needed
- Where good data isn't available, leverage broader field of AI
  - Techniques that don't rely as much on data
- Feature engineering, hence data fusion, becomes important
- The scale and complexity of a DevOps will begin increase due to such interdependencies and other factors (next slide)
  - Systems Engineering principles become important!

SE / AI / ML

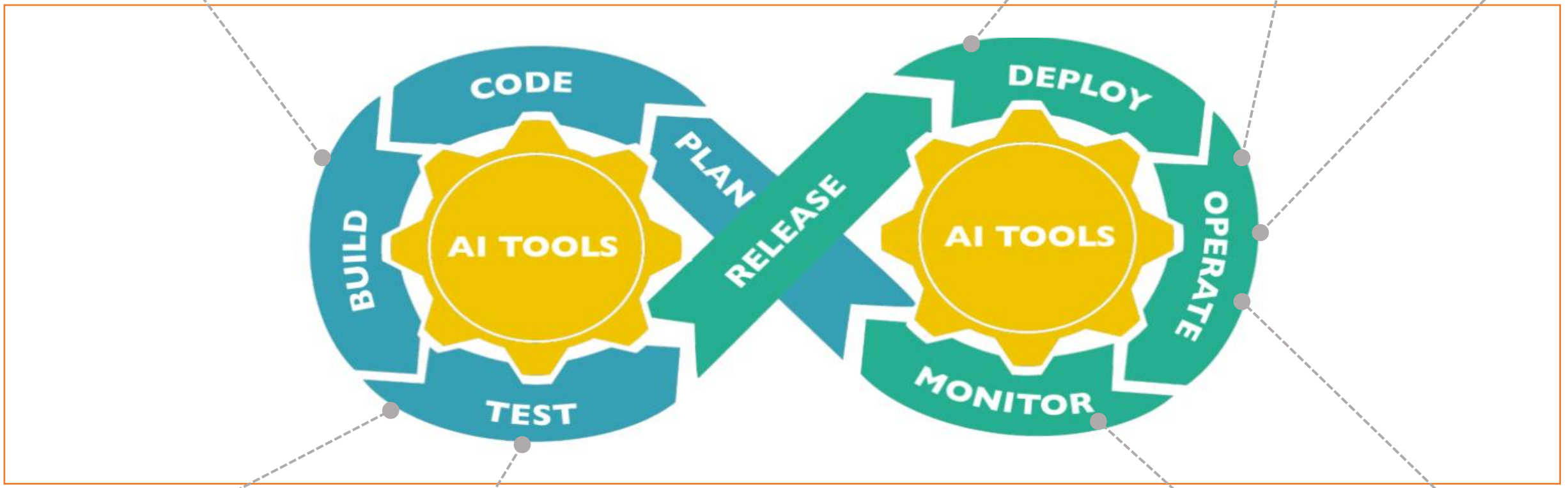
Hard/Soft Fusion

AI Tools: Model-Driven

Noisy Data

Workload

Calibration



Noisy Data

Context of the Data

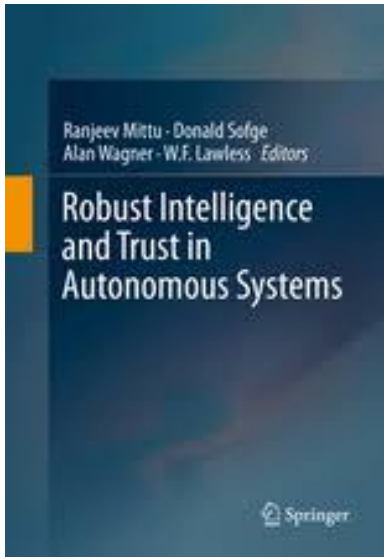
AI Tools: Data-Driven

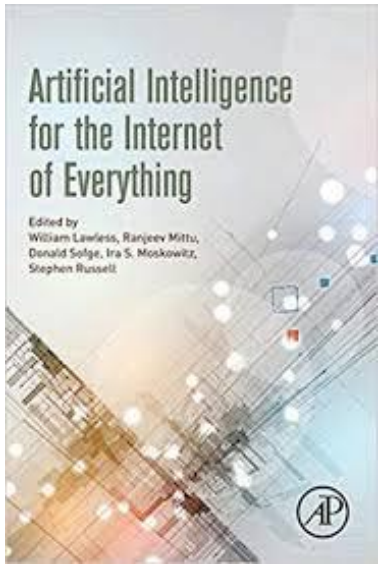
Adversarial attacks

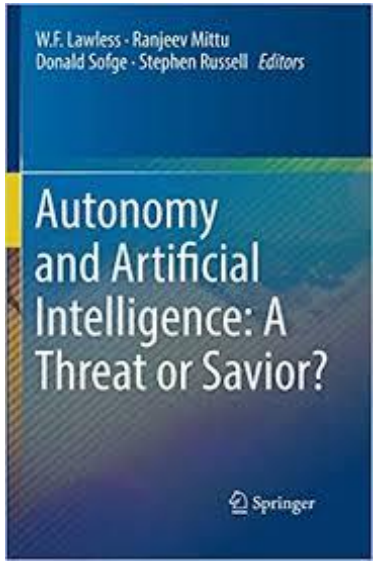
HMI

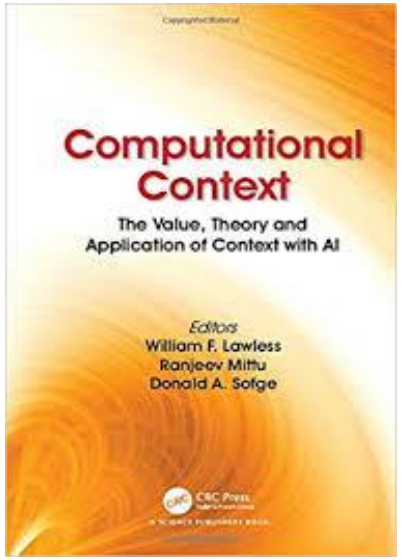
U.S. NAVAL RESEARCH LABORATORY

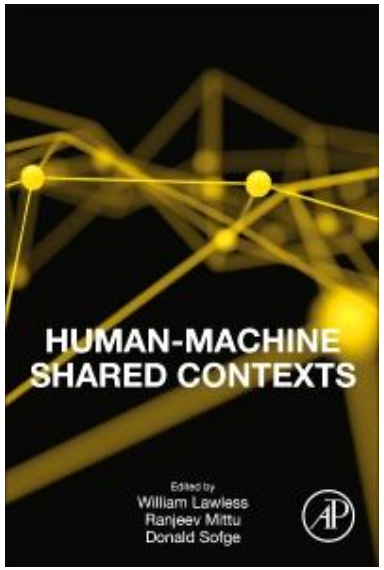
Edited Books Resulting from Past AAAI SSS











Special Issue AI Magazine (2019), "Computational context for human-machine teams"

- **e.g., Uber's self-driving car killed a pedestrian in 2018:** *NTSB* (2018, 5/24): The car saw the pedestrian **6s** ahead and
  selected emergency braking **1.3s** ahead, but emergency brakes were not operational; the human operator took the wheel
  1s before impact and applied brakes **1s** after impact
- **Although disabled, Uber's machine learning (ML) was correct; the human reaction was late.**
- **Because the car did not alert its human teammate, however, it was a poor team player**