Artificial Intelligence Research: A Community Roadmap

CRA Computing Community Consortium (CCC)
Association for the Advancement of Artificial Intelligence
and the computing research community

Leads: Yolanda Gil and Bart Selman
On Behalf of CCC: Daniel Lopresti

AAAS 2020
15 February 2020
With help from Liz Bradley, Ann Drobnis, and Peter Harsha

AAAI
Association for the Advancement of Artificial Intelligence

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Computing Community Consortium
Catalyst

Computing Community Consortium

The mission of the Computing Research Association's Computing Community Consortium (CCC) is to **catalyze** the computing research community and **enable** the pursuit of innovative, high-impact research.

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Association for the Advancement of Artificial Intelligence

The Association for the Advancement of Artificial Intelligence (AAAI) is an international scientific society devoted to promote research in, and responsible use of, artificial intelligence.

AAAI also aims to increase public understanding of AI, improve the teaching and training of AI practitioners, and provide guidance for research planners and funders concerning the importance and potential of current AI developments and future directions.

AI Roadmap: Process

- Summer 2018: CCC discusses potential Roadmap leaders with academia, government, & industrial stakeholders; selects AAAI president (Gil) & president-elect (Selman).
- Fall 2018: Co-leaders, together with AI research community, design three workshops.
- Nov 2018-Jan 2019: Workshops take place.
- Jan 2019: Town hall at AAAI; meetings with key stakeholders.
- Mar-Apr 2019: DC briefings at OSTP, NSF, DARPA, NITRD AI-IWG, DIB, and The Hill with CRA.
- Apr 2019: CCC and community feedback.
- August 2019: final release of AI Roadmap.

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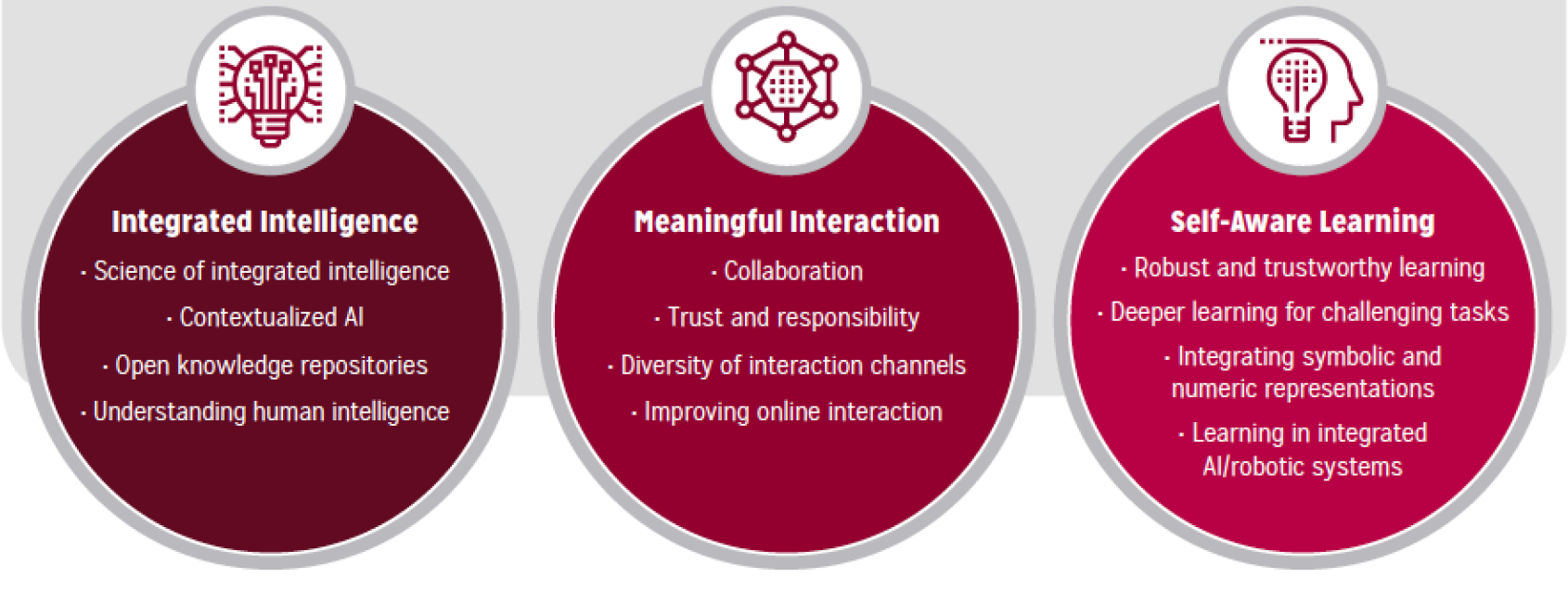
Workshops and Their Leads



Marie des Jardins
Simmons

Ken Forbus
Northwestern

Kathy McKeown
Columbia

Dan Weld
University of Washington

Tom Diettrich
Oregon State University

Fei-Fei Li
Stanford

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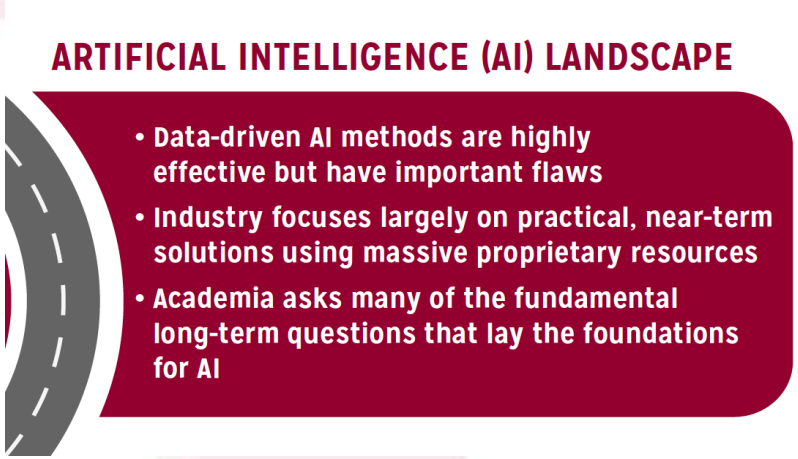
Findings

- AI will be transformative, with rapid, worldwide impact.
- At same time, there are many concerns about security and vulnerability of AI systems.
- Future of work in an AI-enabled world also requires critical attention.
- Accelerating industry successes in AI are built on academic foundations and facilitated by massive data sets, compute power, and human resources.

Findings (cont.)

- Few of AI's big challenges can be solved by piecing together academic research projects.
- Many of the associated issues and problems are outside of industry scope, priorities, and timelines.



- Solving the next generation of AI challenges will require bringing together academia, industry, and government.

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Recommendations

I. National AI Infrastructure

- National AI research centers
- Mission-driven AI labs
- Open AI platforms and resources
- Sustained community-driven AI challenges

II. Training an AI Workforce

III. Core AI Programs

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National AI Research Centers

- Multi-university centers with affiliated institutions, focused on pivotal areas of long-term AI research (e.g., integrated intelligence, trust and responsibility).
- Decade-scale funding to support on the order of 100 faculty, 200 AI engineers, 500 students, and necessary computing infrastructure.
- Visiting fellows from academia, industry, and government will enable cross-cutting research and tech transfer.

Some possible models:

National Artificial Intelligence (AI) Research Institutes:
Accelerating Research, Transforming Society, and Growing the American Workforce

PROGRAM SOLICITATION
NSF 20-503

National Science Foundation

Directorate for Computer and Information Science and Engineering

Directorate for Biological Sciences

Directorate for Education and Human Resources

Directorate for Engineering

Directorate for Geosciences

Directorate for Mathematical and Physical Sciences

Directorate for Social, Behavioral and Economic Sciences

Office of Integrative Activities

National Institute of Food and Agriculture

Department of Homeland Security, Science & Technology Directorate

U.S. Department of Transportation, Federal Highway Administration

U.S. Department of Veterans Affairs

Anticipated Type of Award: Standard Grant or Cooperative Agreement

Estimated Number of Awards: 9 to 14

NSF plans to make 1-6 Institute Awards and approximately 8 Planning Grants.

Anticipated Funding Amount: $24,000,000 to $124,000,000

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The 2019 update to the National Artificial Intelligence Research and Development Strategic Plan, informed by visioning activities in the scientific community as well as interaction with the public, identifies as its first strategic objective the need to make long-term investments in AI research in areas with the potential for long-term payoffs in AI. This funding opportunity seeks to enable such research through a set of new AI Research Institutes.

National Institute of Food and Agriculture

Department of Homeland Security, Science & Technology Directorate

U.S. Department of Transportation, Federal Highway Administration

U.S. Department of Veterans Affairs

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Mission-Driven AI Laboratories

- Living laboratories for AI development in targeted problem domains with major societal impact (AI-ready homes, hospitals, schools, …).
- Designed to allow AI researchers access to unique data and collaborations.
- Decade-scale funding to support permanent researchers, visitors from AI Research Centers, AI engineers and technicians, and domain experts and staff.

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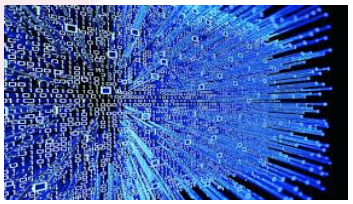
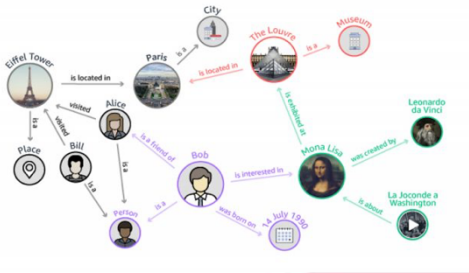
Open AI Platforms and Resources

Open, shared R&D resources:

- AI platforms, facilities, testbeds.
- Data, knowledge bases.
- Toolsets, software, hardware, storage, …

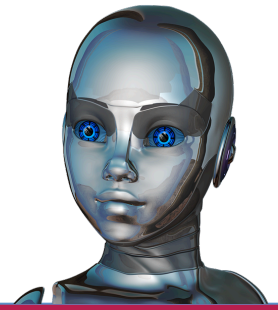




AI Challenges

Sustained community-driven AI challenges:

- Capitalize on energies and synergies that are fostered by healthy competition, while promoting concerted progress on hard AI problems.



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More Recommendations …

II. Training a 21st Century AI Workforce

- Curriculum development, at all levels, incorporating AI ethics and policy.
- Education and training beyond the traditional BA/BS (e.g., community college programs, certificate programs, online post-baccalaurate programs, …).
- Recruitment and retention programs.
- Incentivizing interdisciplinary AI studies (incl. policy, law, societal impact, …).

III. Core AI Programs

- Maintain and extend funding for these critical and fertile programs.

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Societal Drivers

- 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.

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Other CCC AI Panels at AAAS 2020

- "New Approaches to Fairness in Automated Decision Making": Friday, Feb. 14, 8:00 – 9:30 am.
- "Using Computing to Sustainably Feed a Growing Population": Friday, Feb. 14, 3:30 – 5:00 pm.
- "Detecting, Combating, and Identifying Dis and Mis-information": Saturday, Feb. 15, 10:00 – 11:30 am.

Impacts on society are central to community's thinking.

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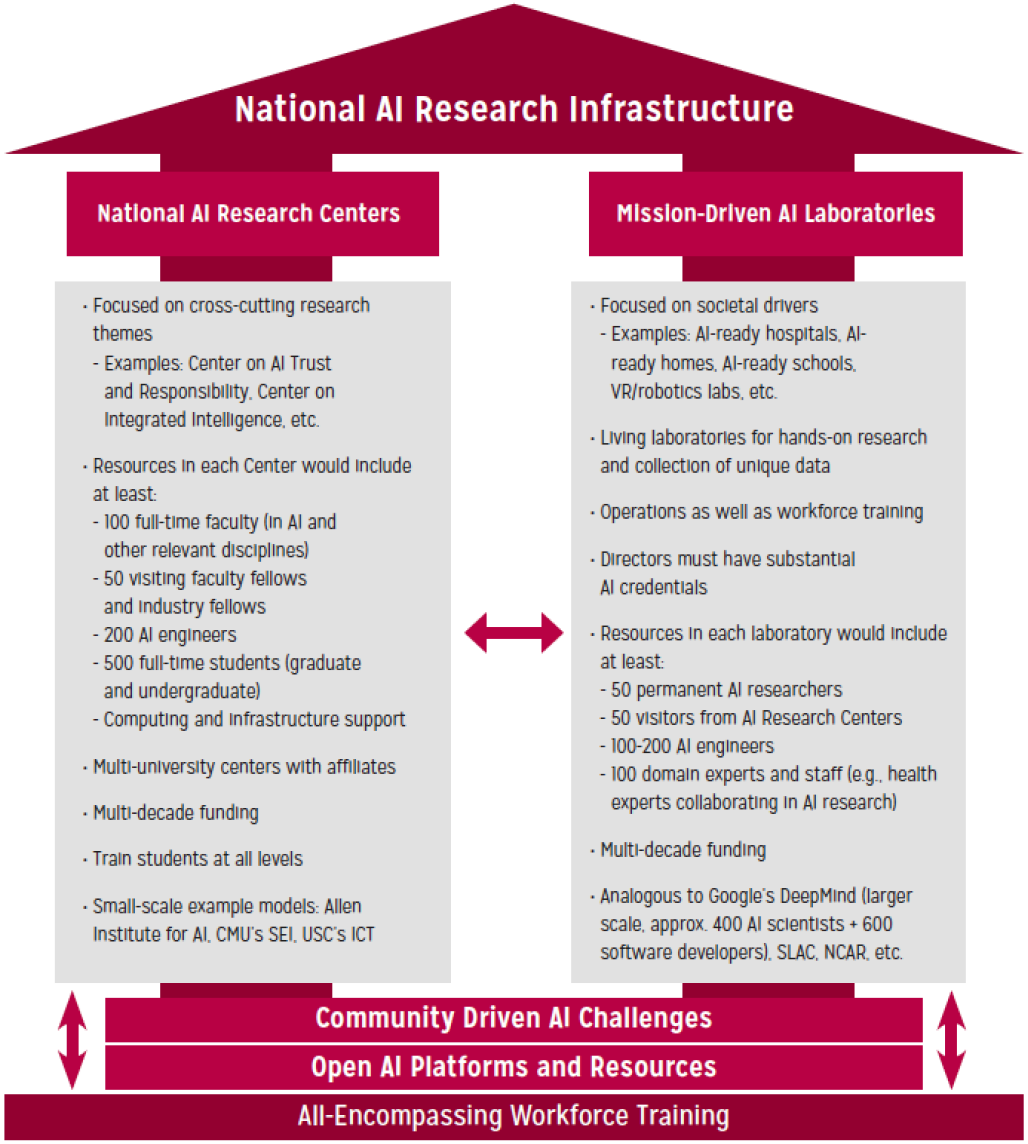
AI Roadmap Foundation and Pillars



Available at: https://cra.org/ccc/

Thank You!











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BACKUP SLIDES

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THE CCC COUNCIL

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Vice Chair: Liz Bradley

Terms ending June 2022

- Sujata Banerjee, VMware
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- Chad Jenkins, University of Michigan
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Terms ending June 2020

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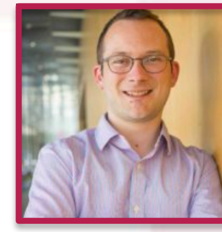














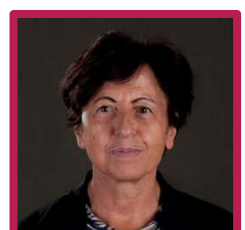

ARTIFICIAL INTELLIGENCE

"Artificial Intelligence is the study of ideas that enable computers to be intelligent. Intelligence includes: ability to reason, ability to acquire and apply knowledge, ability to perceive and manipulate things in the physical world, and others." (PHW 1984)

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- *Symbolic AI*
- logic systems
- planners, theorem provers
- rule-based systems
- qualitative reasoning
- …
- *Statistical AI*
- machine learning
- neural nets
- support vector machines
- Bayesian techniques
- …

- Symbolic AI:
- reasons generally and can report on its reasoning
- but someone has to feed it the operative knowledge
- and “knowledge engineering” is hard.

- Statistical AI:
- works really well, but requires lots of information to learn from (training sets, priors, …)
- output = statistics, not explanations

Challenges to US Leadership in AI

SCIENCE | US & WORLD | TECH

China is about to overtake America in AI research

China will publish more of the most-cited 50 percent of papers than America for the first time this yea

By James Vincent | Mar 14, 2019, 7:03am EDT

The Verge

China Is Starting To Edge Out The US In AI Investment

February 12, 2019

Artificial Intelligence | China | United States

CBINSIGHTS

Intelligent Machines

China may overtake the US with the best AI research in just two years

The number of influential AI research papers coming from China is increasing rapidly, a data analysis shows.

by Will Knight March 13, 2019

MIT TECHNOLOGY REVIEW

BRAINPOWER

Europe—not the US or China—publishes the most AI research papers

By Dave Gershgorn · December 12, 2018

Quartz

16,236 views | Nov 9, 2018, 12:10pm

Artificial Intelligence, China And The U.S. – How The U.S. Is Losing The Technology War

Steve Andriole Contributor

Enterprise & Cloud

Forbes

3,992 views | Sep 7, 2018, 12:03pm

Is South Korea Poised To Be A Leader In AI?

Forbes

This slide is okay for AAAS?