

Being Smart About AI



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Michael Jordan

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Charles Isbell

Georgia Tech



Jim Kurose

OSTP & NSF



This is where the AI business is at right now...



...but we should also consider how we understand and empower humans...



...and what it's like to live and work in an AI-driven world...

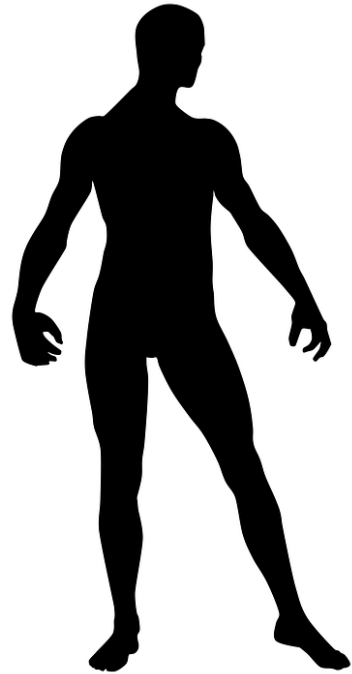


.....because it can go so wrong if done wrong but so right if done right...

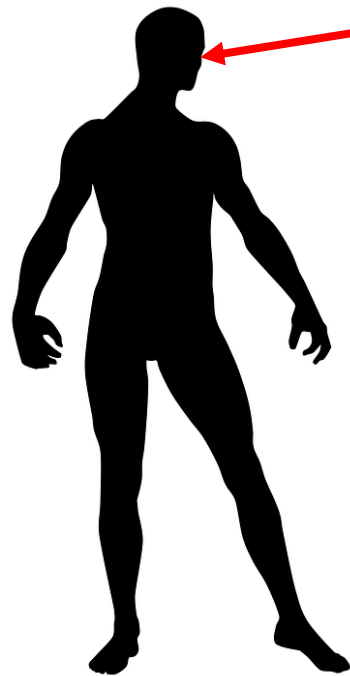


...and so at NSF we are investing strategically in AI.

1965



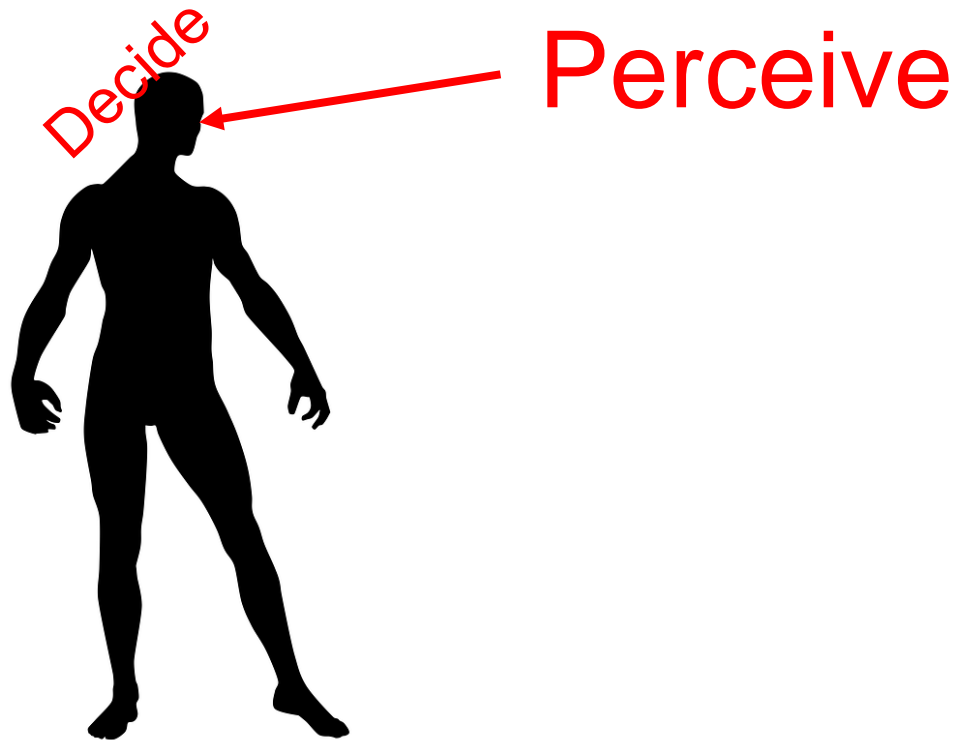
1965



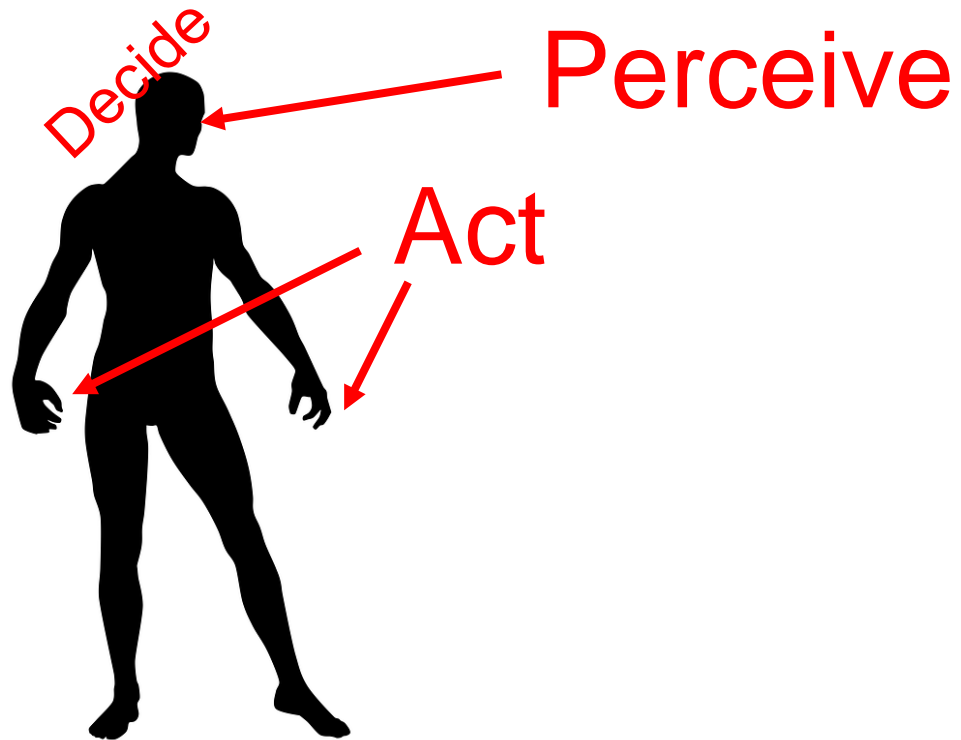
Perceive



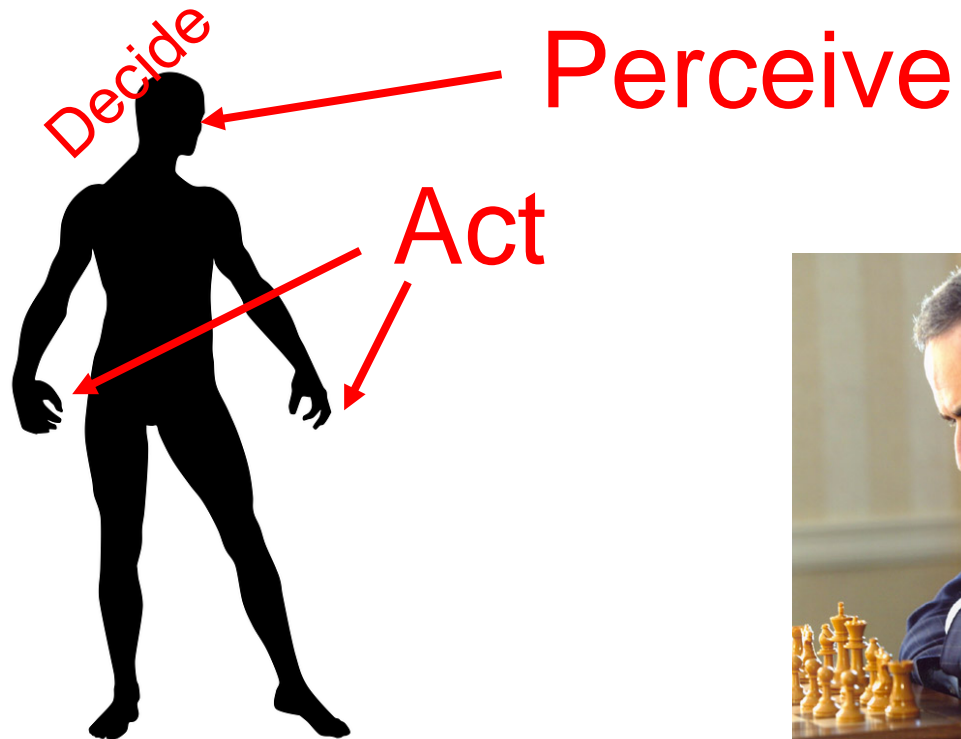
1965



1965



1997 Kasparov Defeat



How Decide Works

Decide

- If I do this then this will happen
- But if I do that then this other thing will happen
- Or if I do this third option...

How do I predict the effects of each action?

1997: Predicting effects

Decide

Software Engineers write a set of Rules that predict the effects

How do I predict the effects of each action?

2003: Predicting effects

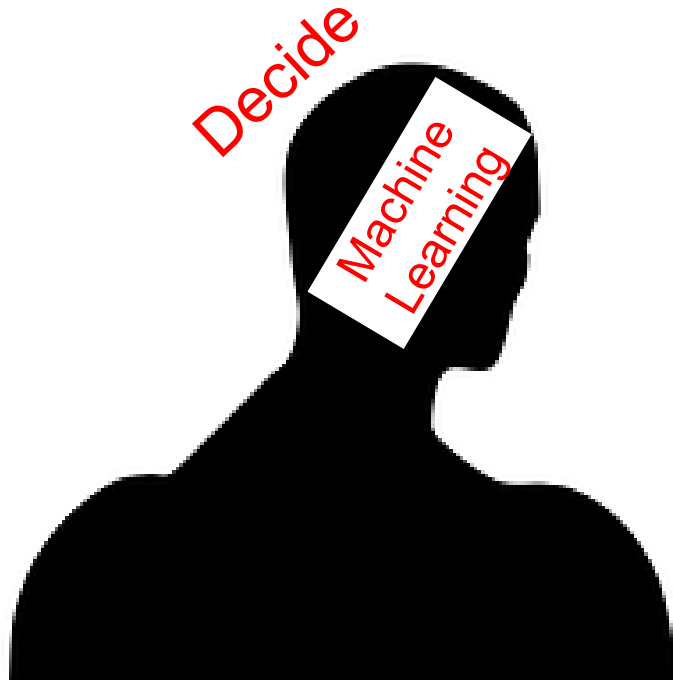
Decide

Machine
Learning

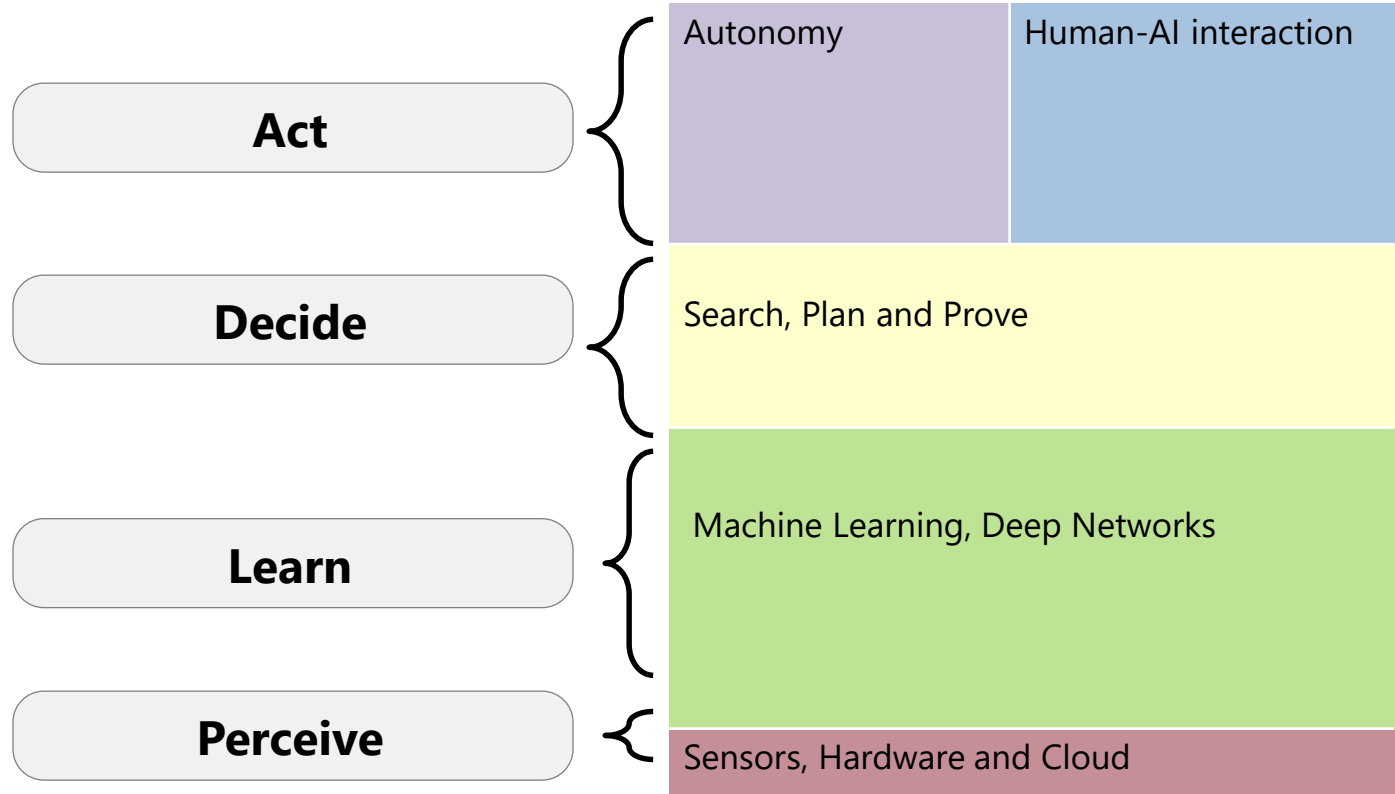
Learn to predict by
extrapolating from
previous data

How do I predict the effects of
each action?

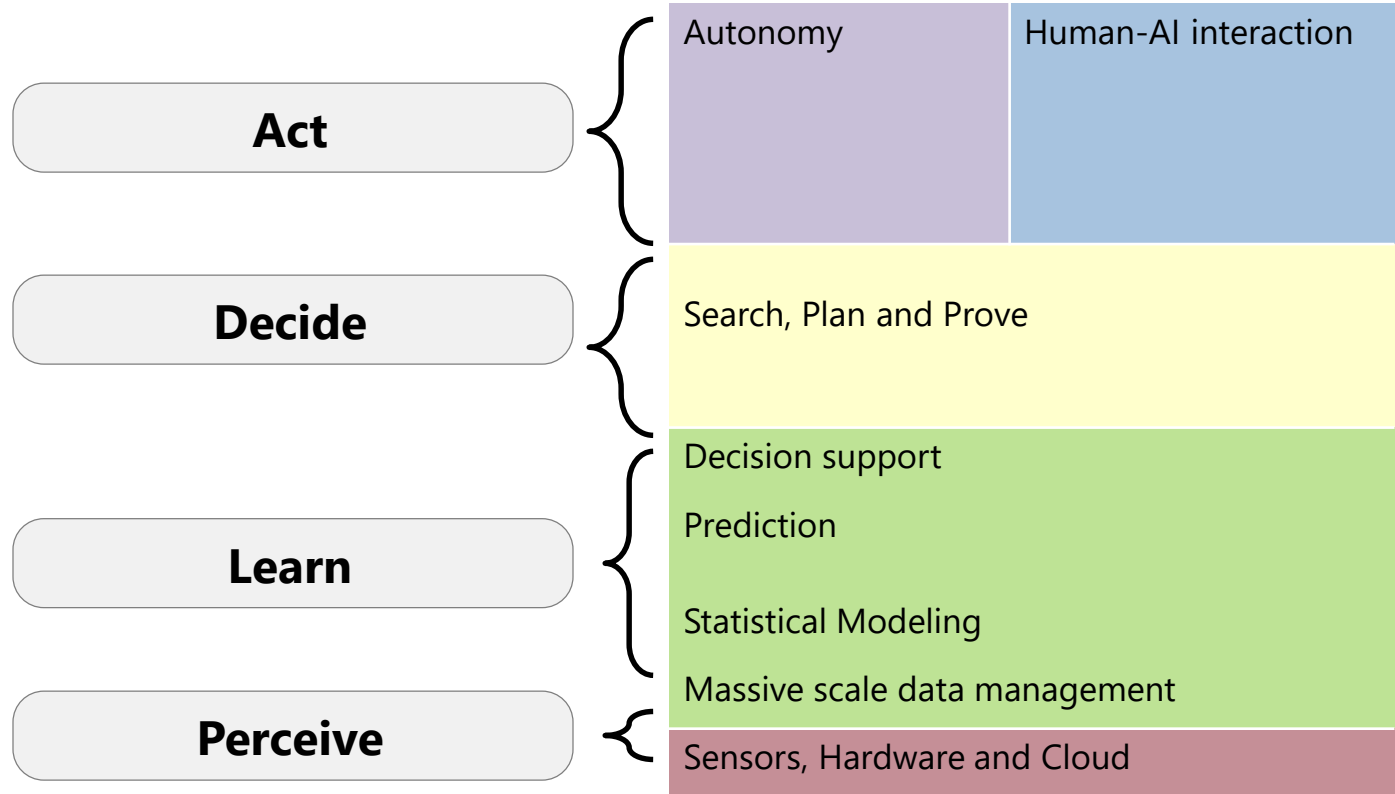
Learning




The AI Technology Stack



The AI Stack





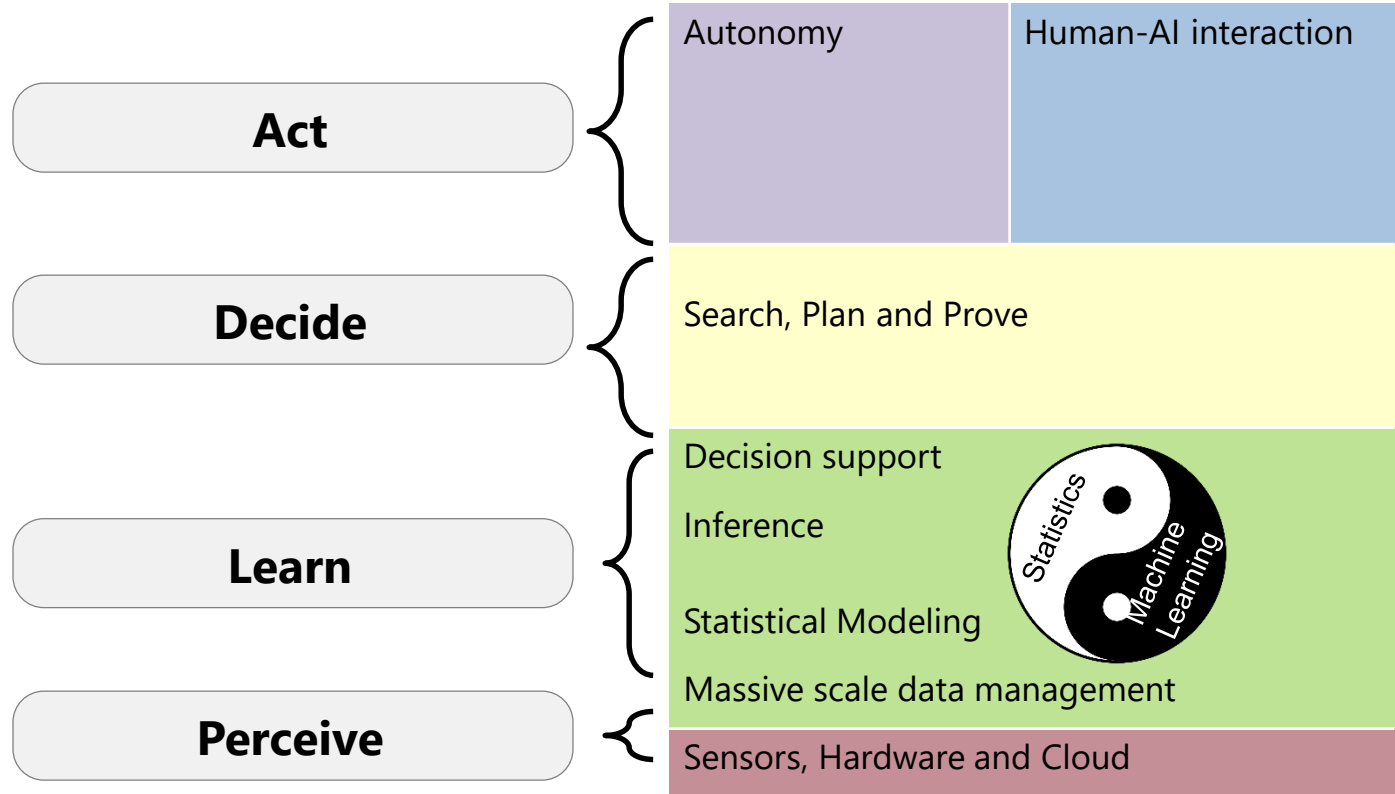


Machine
Learning

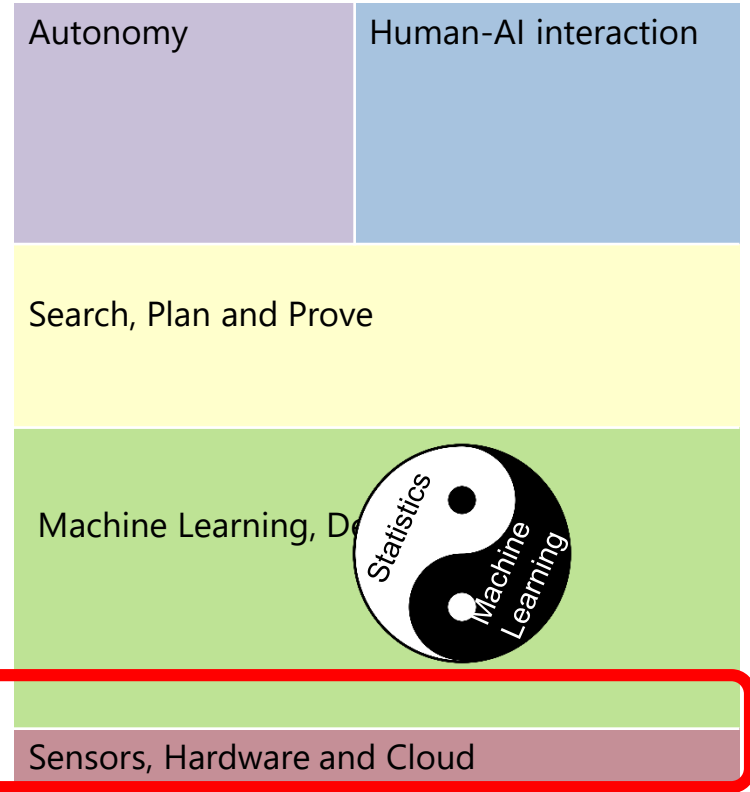
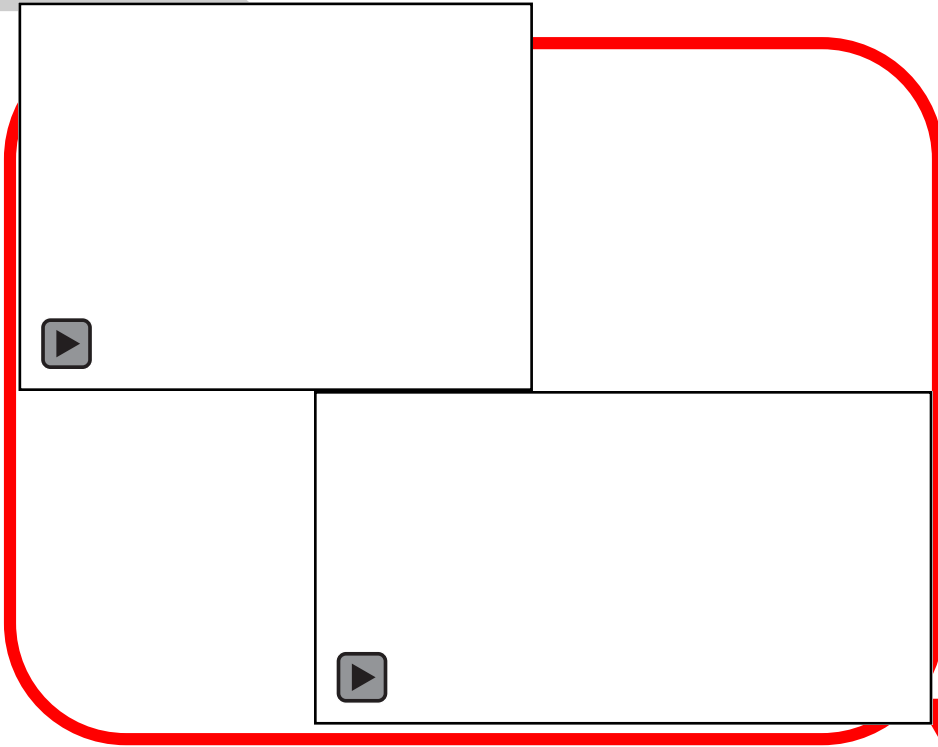
AI

Statistics

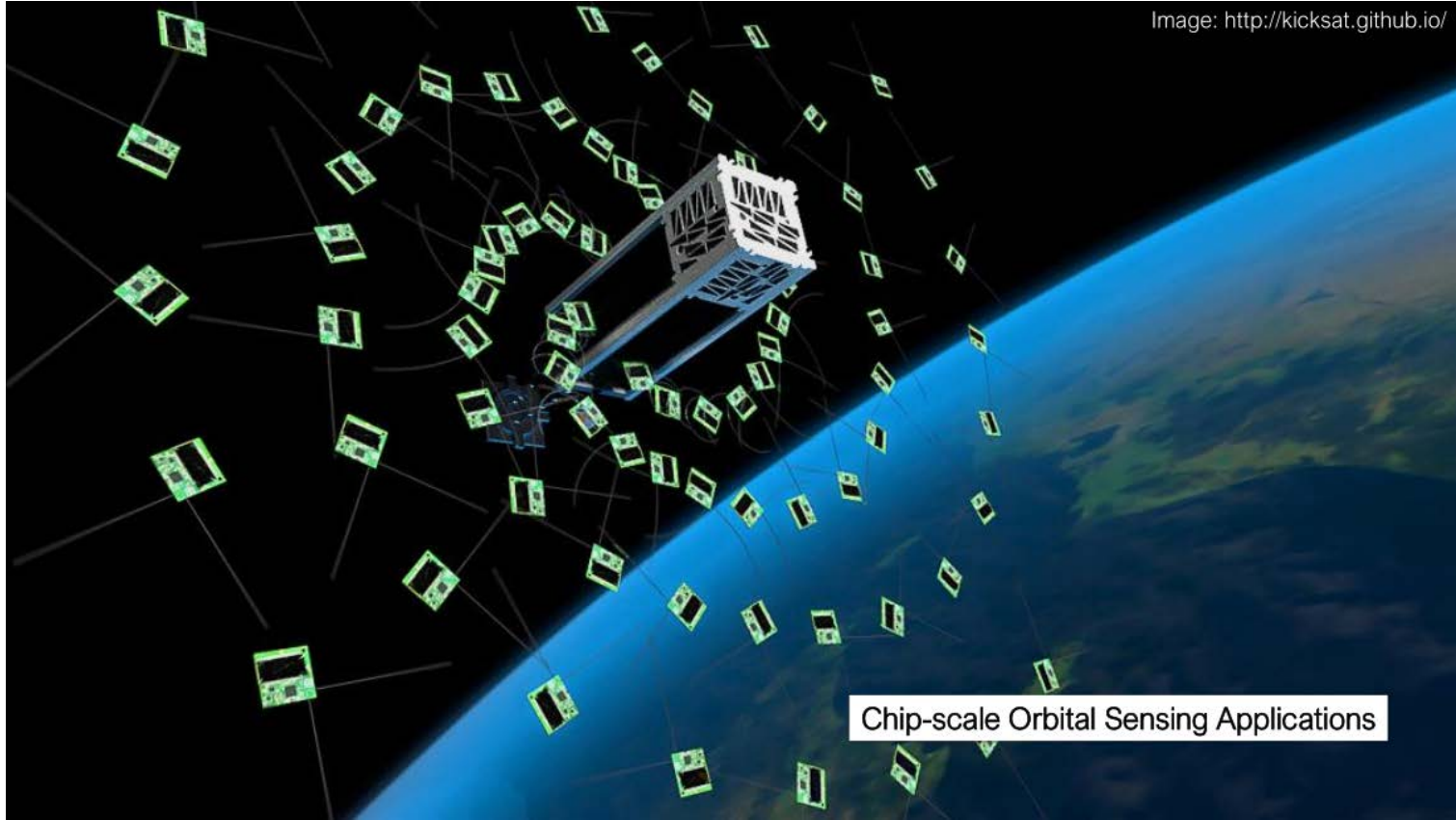
The AI Stack



The AI Stack

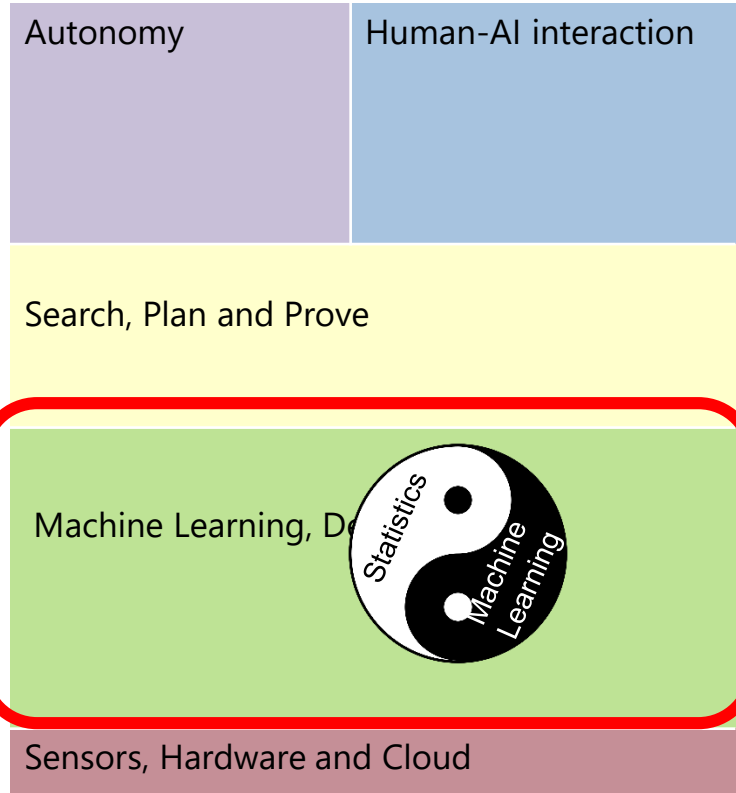


1 mA neural network image detection



The AI Stack

Video unsupported



Safety



Mike Wagner

Phil Koopman



Autonomy

Human-AI interaction

Search, Plan and Prove

Machine Learning, Deep Networks

Sensors, Hardware and Cloud

Negotiation & Deception



Autonomy

Human-AI interaction

Search and analysis

Optimize

Safety

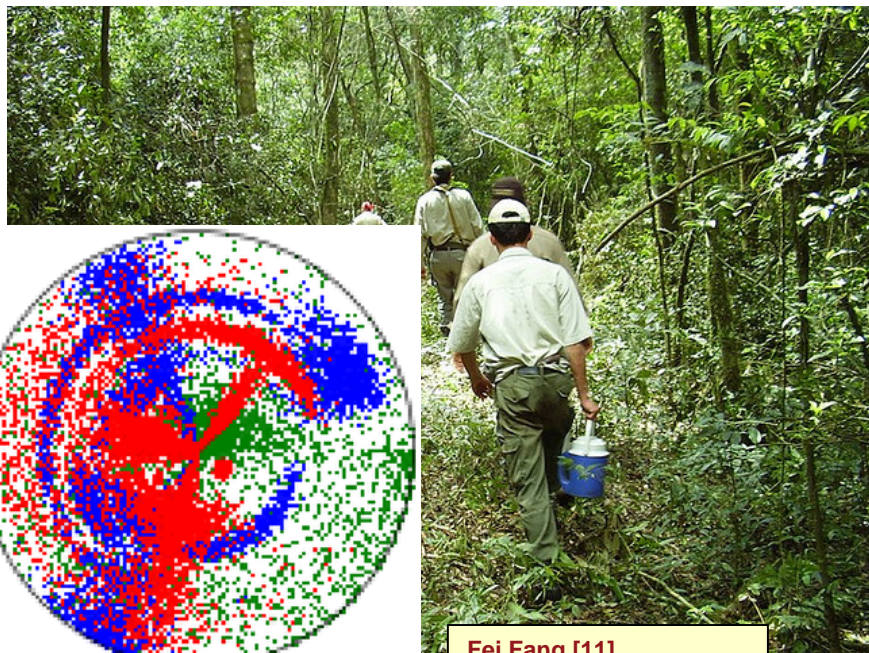
Knowledge Network

Game Theory

Machine Learning, Deep Networks

Sensors, Hardware and Cloud

Negotiation & Surveillance



Fei Fang [11]

Autonomy

Human-AI interaction

Search and analysis

Optimize

Safety

Knowledge Network

Game Theory

Machine Learning, Deep Networks

Sensors, Hardware and Cloud

Human-AI



Henny Admoni

Autonomy

Human-AI interaction

Search, Plan and Prove

Machine Learning, Deep Networks

Sensors, Hardware and Cloud

Autonomy



Leidos (autonomy by CMU)

Autonomy

Human-AI interaction

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Machine Learning, Deep Networks

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Autonomy



Autonomy

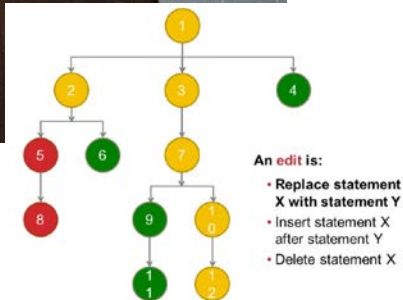
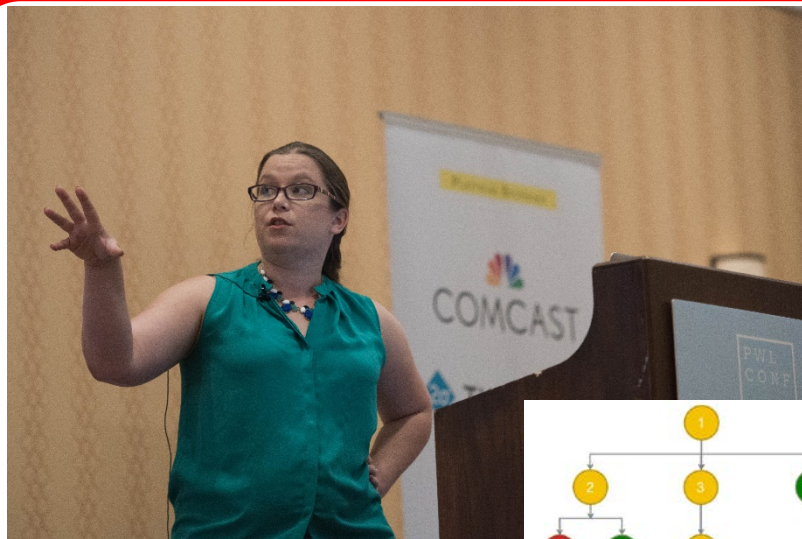
Human-AI interaction

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Autonomy

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...and so at NSF we are investing strategically in AI.

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• Using algorithms to match live kidney donors with recipients:
https://www.cmu.edu/news/archive/2010/November/nov16_kidneyalgorithm.shtml
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https://users.ece.cmu.edu/~koopman/pubs/koopman16_sae_autonomous_validation.pdf
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<http://symbolaris.com/info/KeYmaera.html>
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• CMU Wins Cyber Attack Challenge:
<http://www.cmu.edu/news/stories/archives/2016/august/cyber-attack-challenge-winner.html>
• Paper: Using MAYHEM on Binary Code: <https://users.ece.cmu.edu/~arebert/papers/mayhem-oakland-12.pdf>
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• Crowd-sourced prosthetics; Giving a Hand to Those in Need:
<https://www.hcii.cmu.edu/news/2016/giving-hand-those-need>
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• Medrobotics: <http://medrobotics.com/>
• Highly Articulated Robotics Probe for Minimally Invasive Surgery:
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2923469>
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- [11] Fei Fang---game theory against poaching, logging and mining <https://feifang.info/research/>
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- [13] <https://news.brown.edu/articles/2017/08/surveillance>
- [14] <https://www.cs.cmu.edu/~mfredrik/papers/fredrikson-usenix14-genomic.pdf>
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- [16] Sandholm and Brown, CMU CS,
<http://www.cs.cmu.edu/~sandholm/safeAndNested.aaa17WS.pdf>