



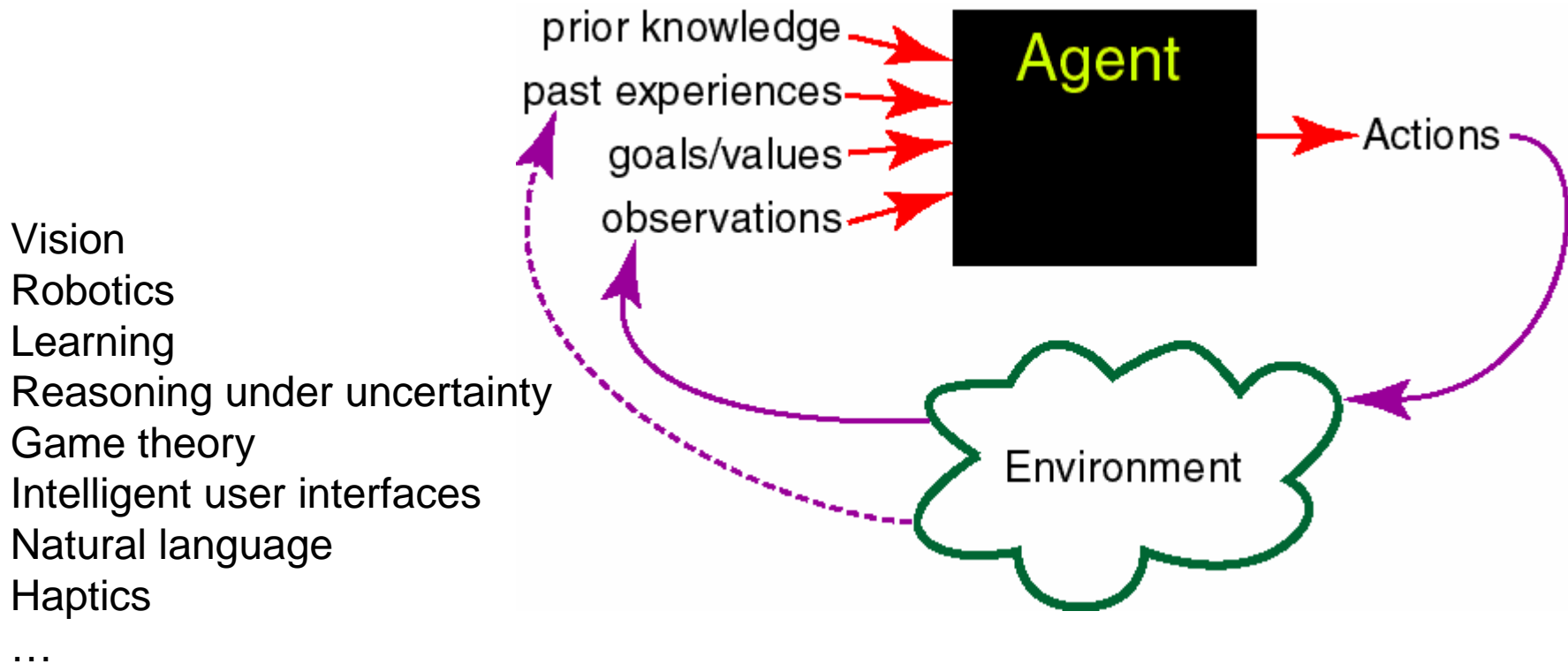
Welcome to LCI!
**The Laboratory for
Computational Intelligence**





AI as Study and Design of Intelligent Agents

- An *intelligent agent* is such that
 - Its *actions* are *appropriate* for its goals, given the current environment
 - It is *flexible* to changing environments and goals
 - It *learns* from experience





14 faculty members

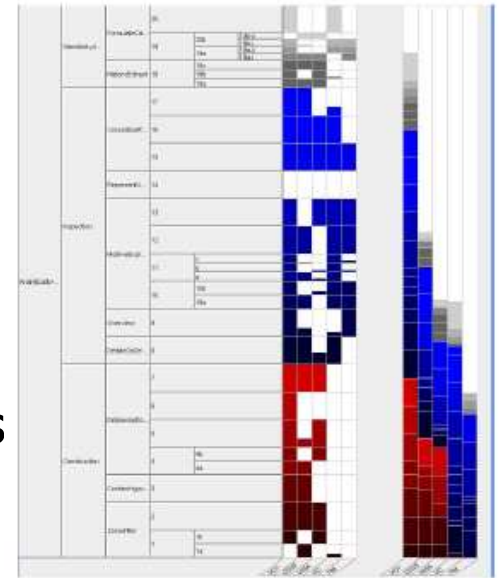
- Cristina Conati Adaptive Interface Agents
 - Giuseppe Carenini NLP, Decision Support Systems
 - Karon Mclean Haptics
 - Nando De Freitas
 - Kevin Murphy
 - *Arnaud Doucet*
 - David Poole
 - Kevin Leyton-Brown
 - Holger Hoos
 - David Lowe
 - Bob Woodham
 - Jim Little
 - Alan Mackworth
 - *Dinesh Pai*
- Intelligent User Interfaces**
- Machine learning**
- Decision/ game theory**
- Empirical algorithms**
- Computer vision**
- Mobile robotics**



Giuseppe Carenini



- Intersection of computational linguistics, HCI and decision theory
- Generation of understandable and convincing multimedia presentations
 - explanations, arguments, reports, summaries and narratives tailored to the interaction context
 - combine natural language and information graphics
 - provide interactive means for enabling users to further explore the information presented.



AutoBrief: an explanation of a lift shortfall

Lift Capacity Problem for TPFDD Cyberland-1

Figure 1: The relationship of the amount of non-PAX cargo of needed capacity on each date from C2 to C5 to the amount of non-PAX cargo of available capacity on each date from C2 to C5.

The date with the largest difference between needed and available lift capacity is 4.

The amount of non-PAX cargo of needed capacity on C4 exceeds the amount of non-PAX cargo of available capacity on C4 by the amount of 177.8 tons of cargo.

Summary of customer reviews for: Apex AD2600 Progressive-scan DVD player

Most customers liked the Apex AD2600¹. Although many customers found the user interface² to be good, many users thought the available video outputs³ were poor. However, many users liked the range of compatible disc formats⁴, even though many customers found the compatibility with DVD audio⁵ discs to be very poor.

For the price, it's a very nice dvd player. The front door is miss aligned on my unit and you have to manually lift it up just so slightly for the door to close, a very annoying thing after awhile. It does play a wide range of formats as advertised which is very nice. And so far have not had any problems with discs not being able to play. Recommended to anyone looking to purchase a low priced dvd player and not expecting any bells or whistles from a brand name one like sony.

HOUSE QUALITY

Quality	Exterior Appearance	Architectural Style	View Quality	View Content
2.33	EXCELLENT	VICTORIAN	GOOD	PARK
1.15	terrible	olde	poor	houses
1.25	good	modern	fair	houses
1.8	poor	modern	fair	park
2.13	good	olde	good	university
2.27	excellent	modern	good	park
2.33	good	olde	excellent	view
2.38	excellent	victorian	good	houses
3.31	good	modern	fair	view
3.38	excellent	modern	good	houses
3.4	poor	olde	poor	houses
4.16	poor	modern	good	houses
A.23	excellent	victorian	excellent	park
A.18	poor	modern	good	university
B.19	fair	modern	good	view
C.28	poor	victorian	excellent	view
C.38	poor	victorian	good	view

House 2.33 is an interesting house. In fact, it has a convenient location in the lively Northside neighborhood. Even though the traffic is intense on 2nd street, house 2.33 offers an easy access to the park (0.2 miles). And also it is close to work (1.5 miles).

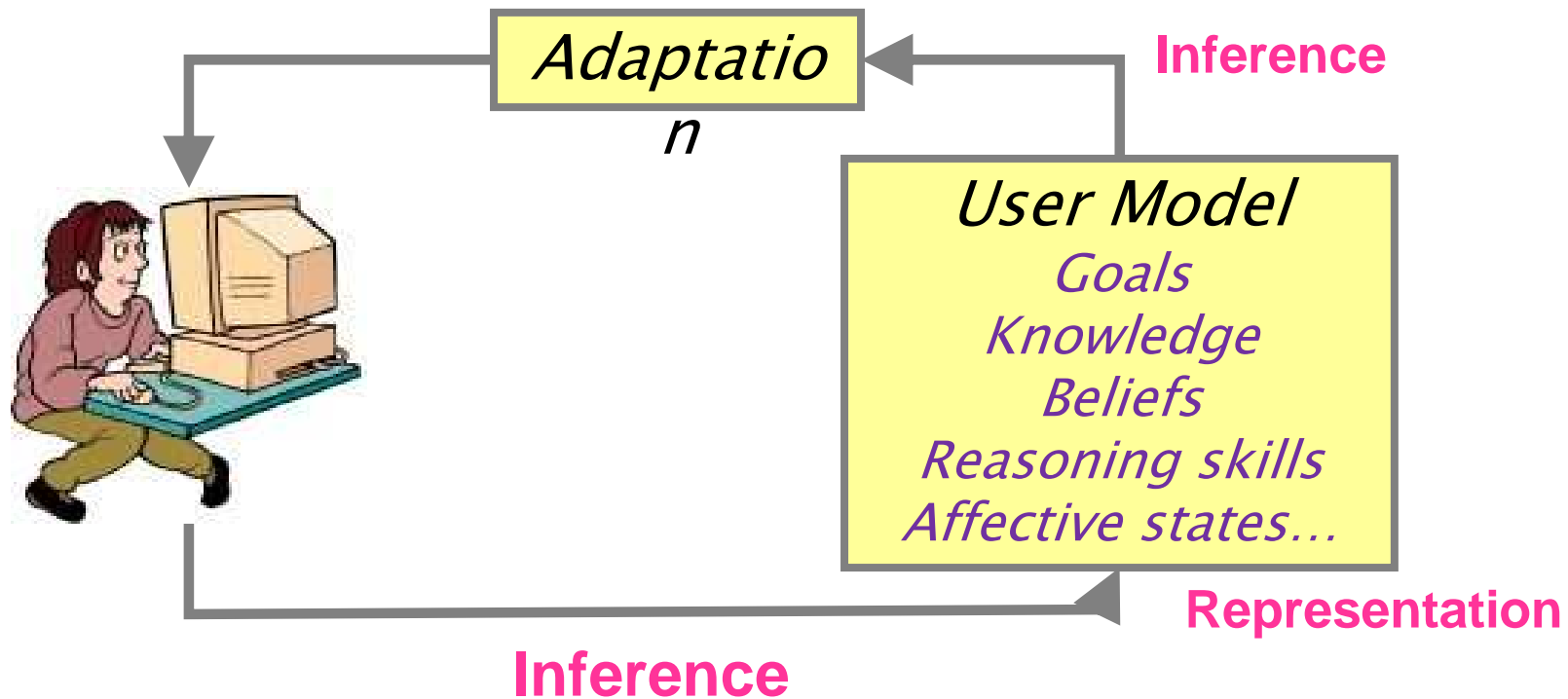


Cristina Conati



Intelligent User Interfaces

- integrate research in AI, HCI and Cognitive Science to devise interactive systems that can *autonomously adapt* to their users' needs
- How to *infer, represent* and *reason about* non-trivial user features relevant to intelligently adapt to the user's needs





Arnaud Doucet

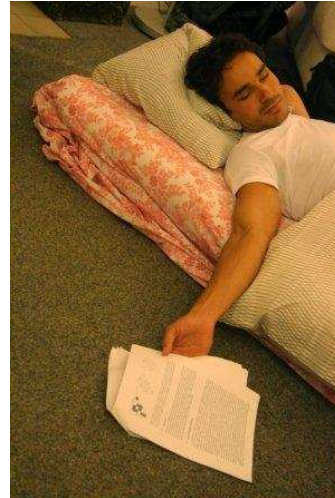


- Simulation-Based Methods
 - Bayesian statistics
 - Decision under uncertainty
 - Optimization of structured stochastic systems
- Applications
 - Classification and regression in complex models
 - Bioinformatics, computational genetics, tracking

$$\begin{aligned} \pi_{\theta}(x_n, Y_n) = & \\ & \left[\int \int \alpha_{\theta}(x_{n-1:n}, Y_n) q_{\theta}(x_n | Y_n, x_{n-1}) p_{\theta}(x_{n-1} | Y_{1:n-1}) dx_{n-1:n} \right]^{-1} \\ & \times \left\{ \int \nabla \alpha_{\theta}(x_{n-1:n}, Y_n) q_{\theta}(x_n | Y_n, x_{n-1}) p_{\theta}(x_{n-1} | Y_{1:n-1}) dx_{n-1} \right. \\ & + \int \alpha_{\theta}(x_{n-1:n}, Y_n) \nabla q_{\theta}(x_n | Y_n, x_{n-1}) p_{\theta}(x_{n-1} | Y_{1:n-1}) dx_{n-1} \\ & \left. + \int \alpha_{\theta}(x_{n-1:n}, Y_n) q_{\theta}(x_n | Y_n, x_{n-1}) \nabla p_{\theta}(x_{n-1} | Y_{1:n-1}) dx_{n-1} \right\} \end{aligned}$$



Nando de Freitas

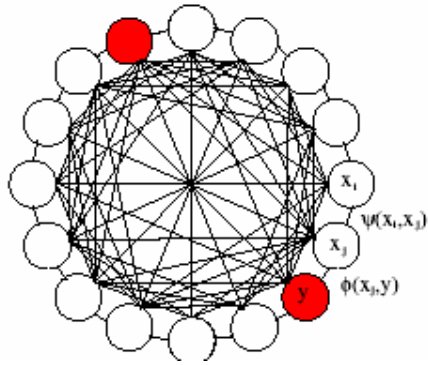


- Active learning, optimal control, decision making under uncertainty, performing the right experiment, asking the right questions, marrying the right person.

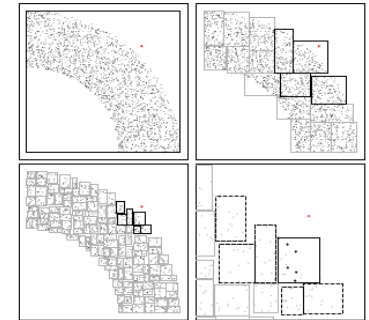


- Particle filtering, Monte Carlo and N-Body simulation.

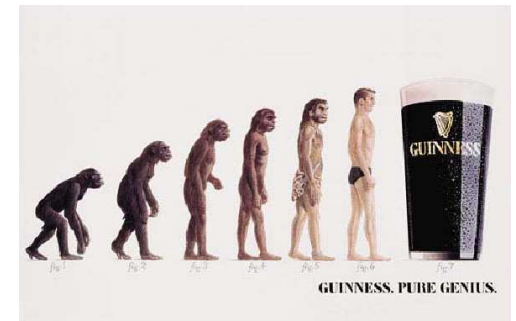
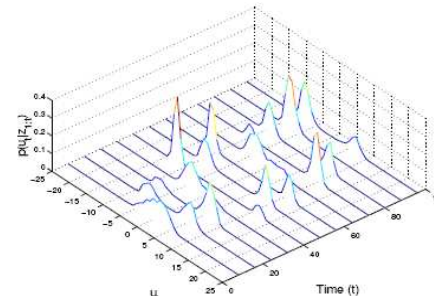
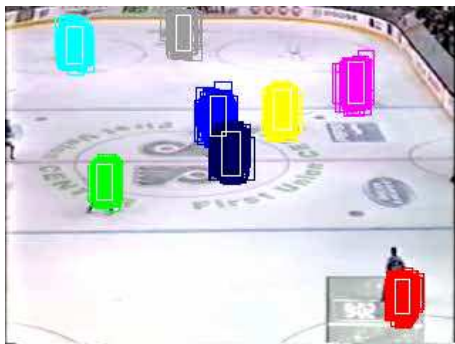
- Learning in large distributed systems: factor graphs, random fields, brains.



- Learning relations, object identity and the number of objects in probabilistic first order logic systems.



- ... Mars rovers, multimedia search engines, music, animation, tracking, object recognition, games, sensor networks and robotics.



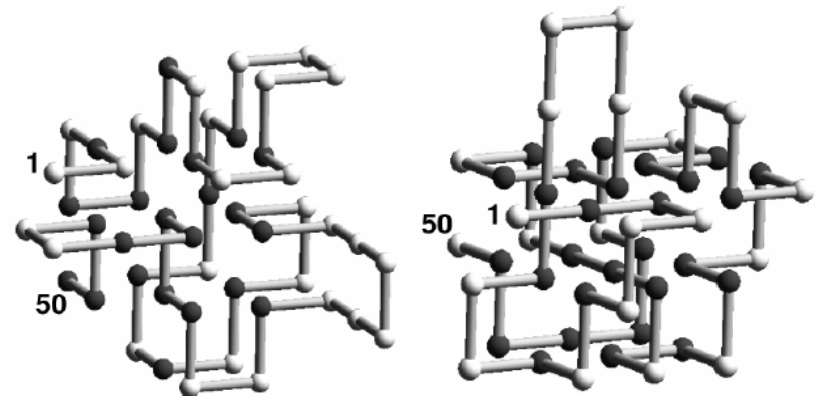
GUINNESS. PURE GENIUS.



Holger Hoos



- Hard combinatorial problems from AI and Bioinformatics
- Design and characterisation of stochastic local search algorithms for such problems
- Human-centred information management
- Computer music

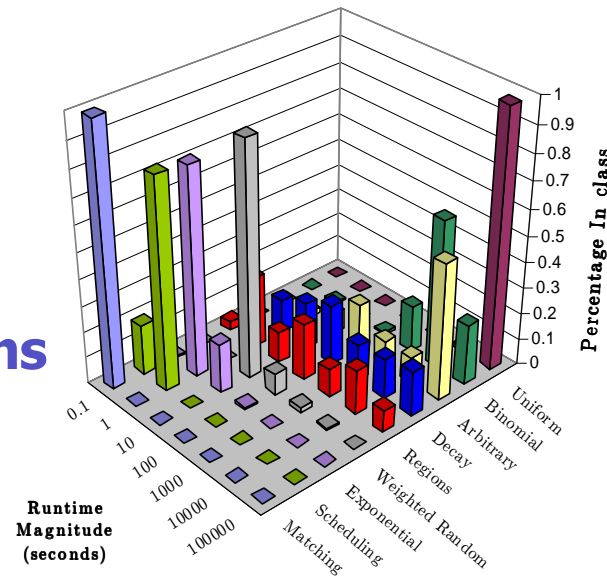




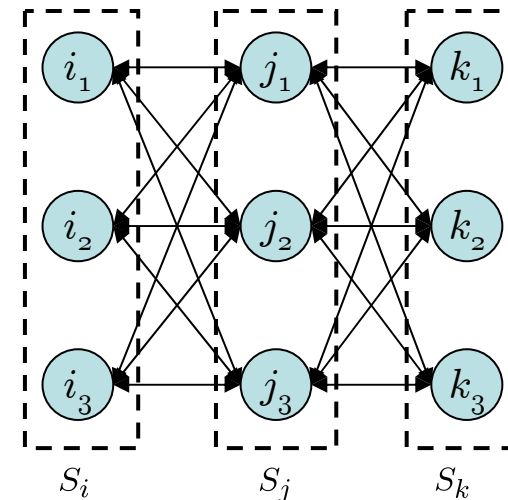
Kevin Leyton-Brown



- Research goals:
 - theoretical problems in **multiagent systems**
 - understanding **empirical properties of algorithms**



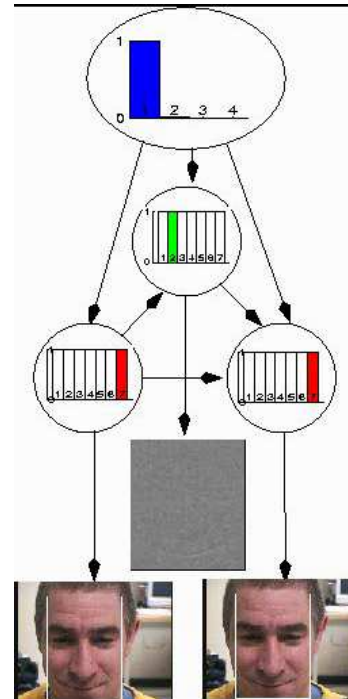
- Research areas:
 - Computational Game Theory
 - Auction Theory, Mechanism Design
 - Trading Agents
 - Bounded Rationality
 - Empirical Hardness Models





Jim Little

Cognitive vision
Action recognition
Visual tracking
Mobile robotics





David Lowe

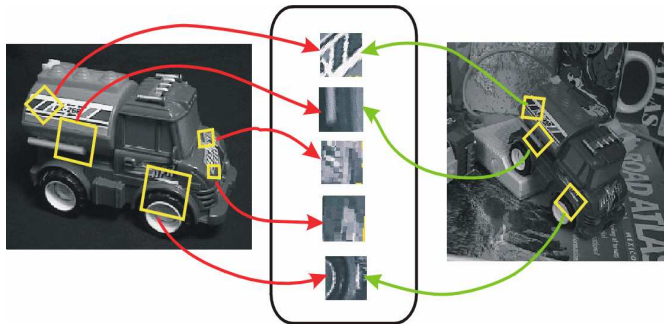


Object recognition

Invariant image features (SIFT)

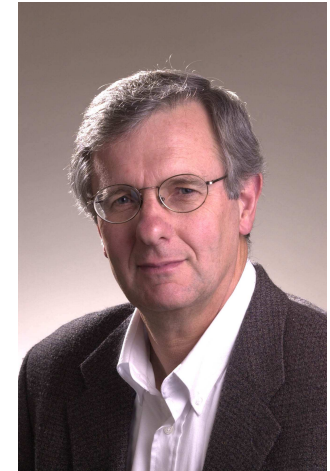
Panorama stitching, augmented reality

Recognition in large image databases

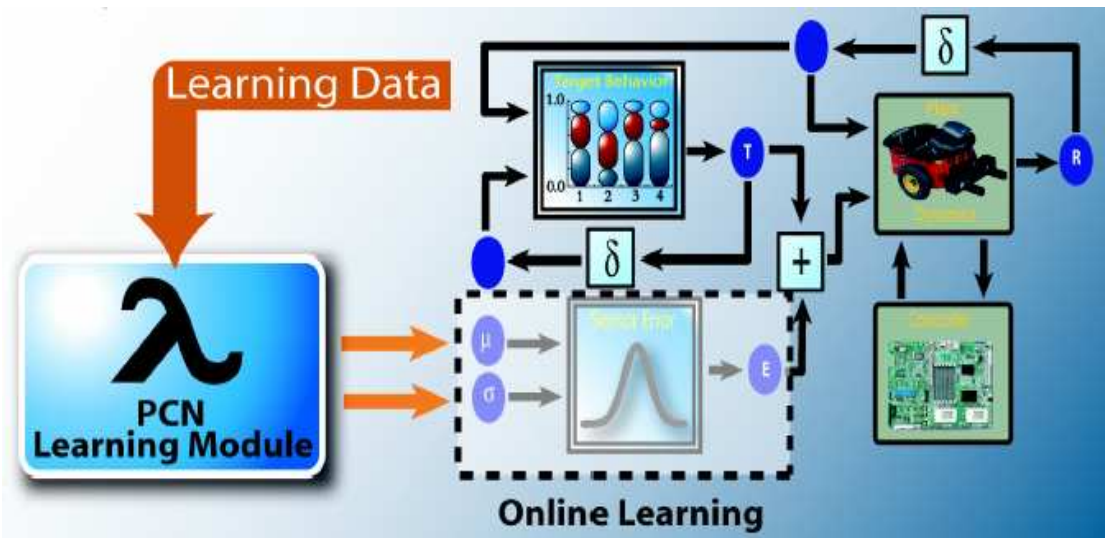




Alan Mackworth

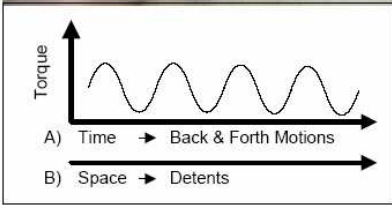
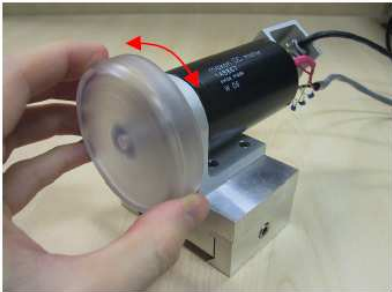


- Constraint-based agents: models, languages and systems
- Computational vision and robotics
- Multiagent systems including soccer-playing robots
- Specification, modeling and verification of hybrid dynamical systems



Karon Maclean

robotics / haptic interfaces



physical user interfaces:

talking to computers through your hands
defining perceptual spaces → language

haptic force feedback

novel devices

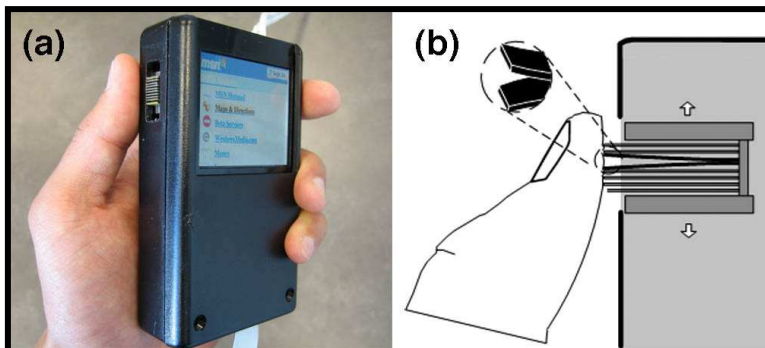
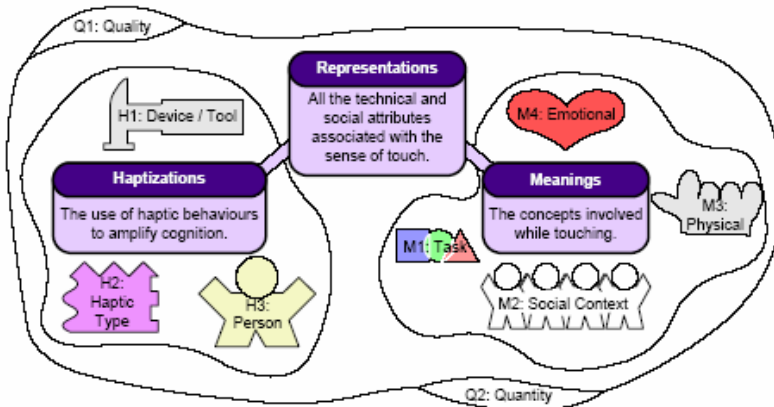
embedding interfaces in the world:
cars, homes, portables

expressive control - art & streaming media

transparent multisensory interfaces

non-conscious interfaces

haptic guidance: sharing control w/ intelligent systems





Kevin Murphy



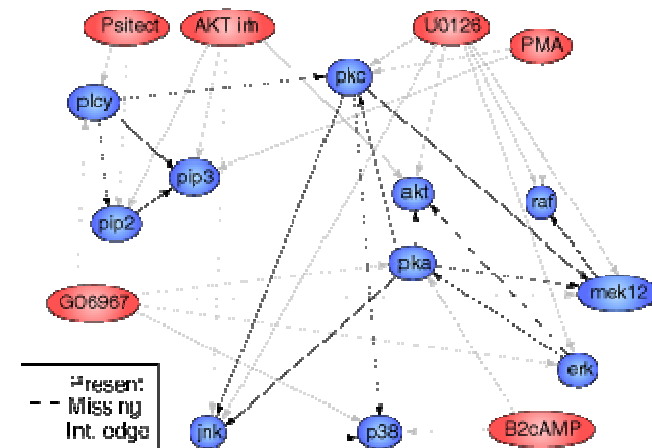
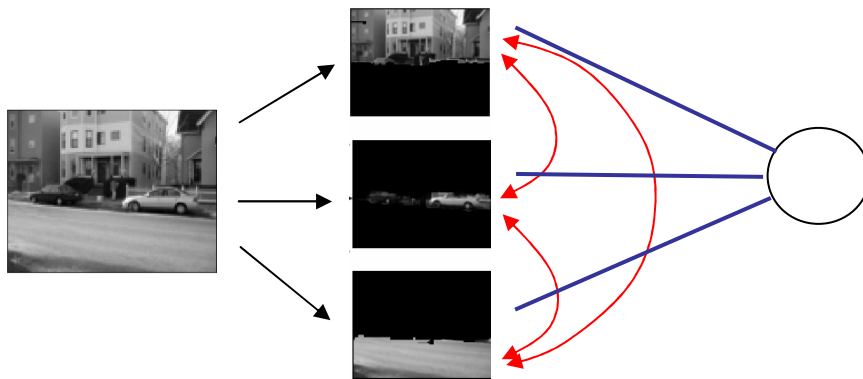
- Machine learning

- Probabilistic graphical models
- Algorithms for Bayesian statistics

$$p(\theta|D) = \frac{p(D|\theta)p(\theta)}{p(D)}$$

- Applications

- Visual object detection and scene understanding
- Computational biology, network discovery

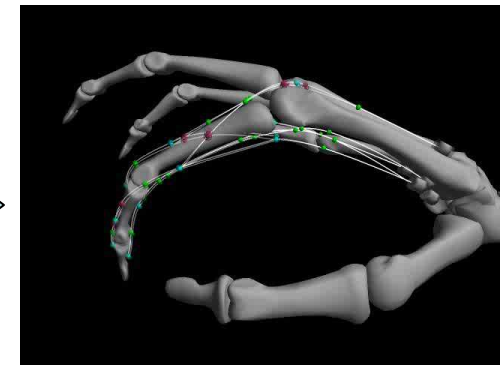
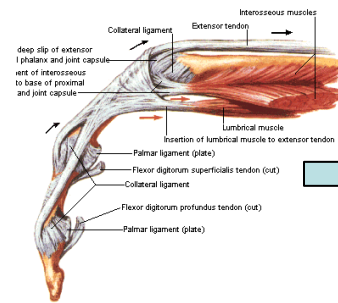
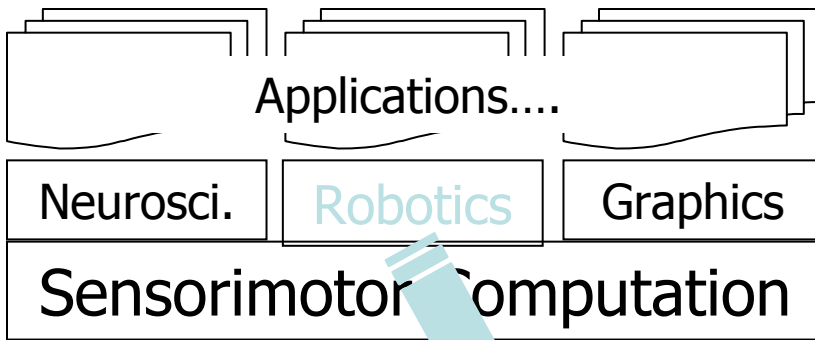




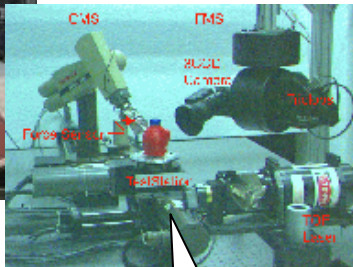
Dinesh K. Pai



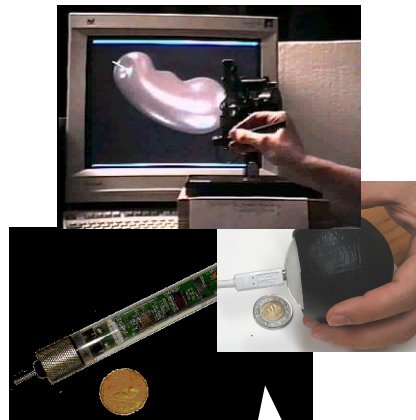
- Research: **Sensorimotor Computation**



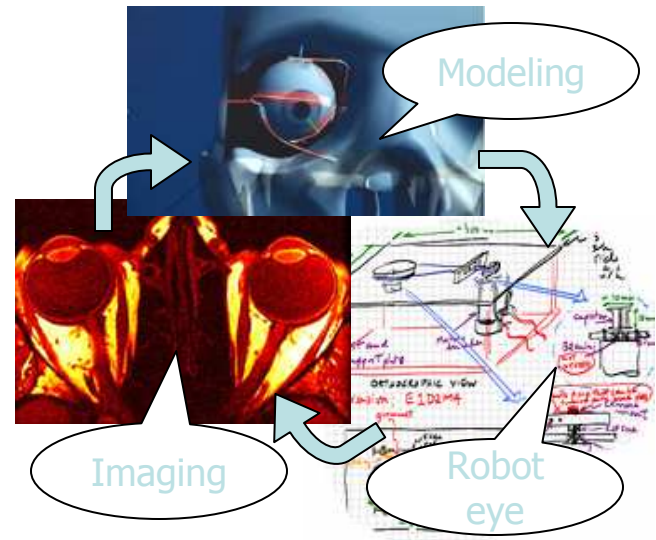
Platonic Beast



ACME

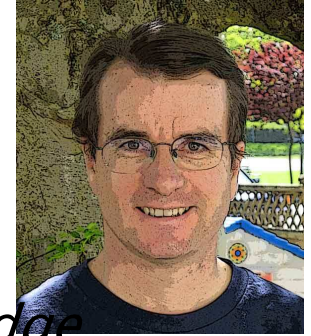


Haptics

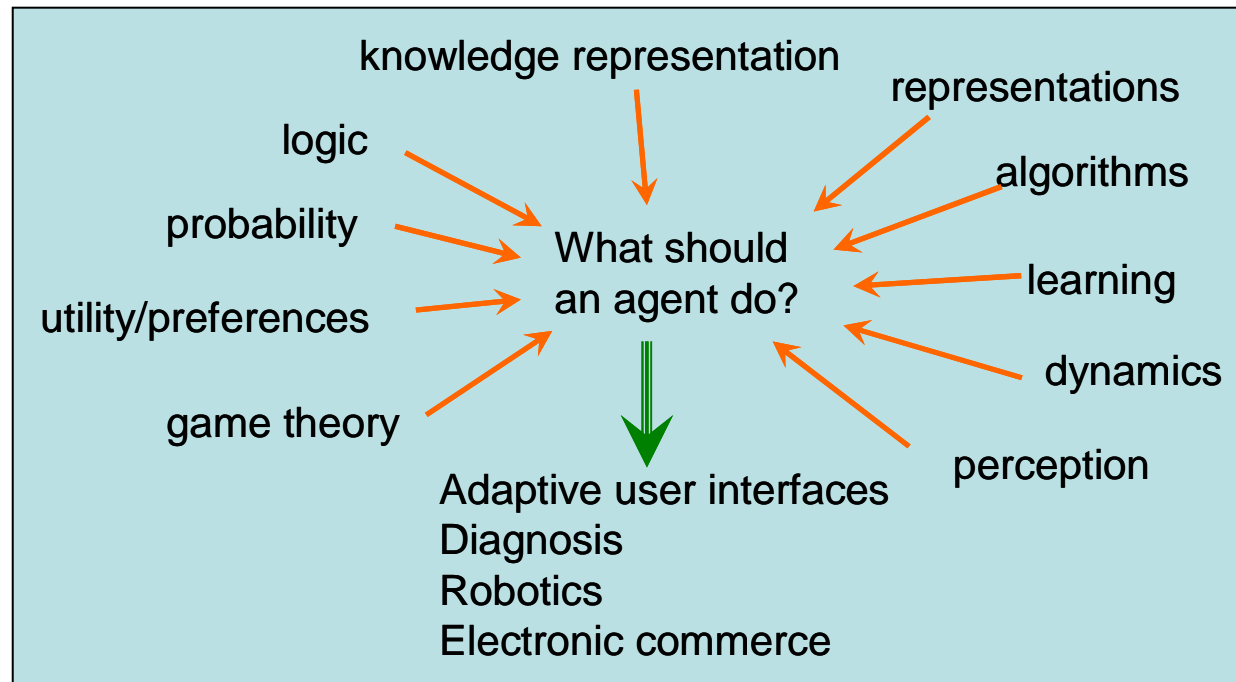




David Poole



“What should an agent do based on its prior knowledge, what it observes about the world, and its values or goals?”





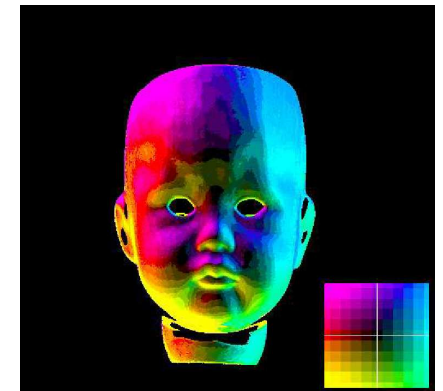
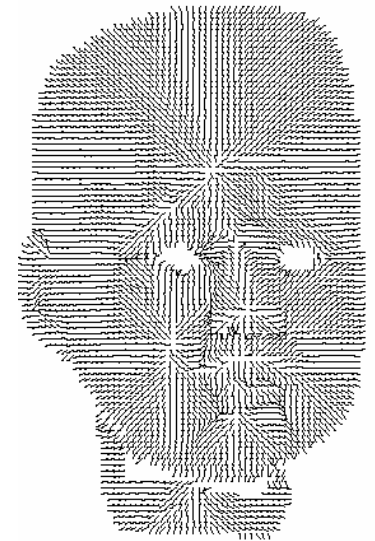
Robert J. Woodham



- **Focus:** Computer interpretation of 3D shape and visual motion
- **Objective:** To understand how the measurement of visual motion can support high-level interpretation tasks related to object identity, non-visual physical properties and, for an object that is an intelligent agent, to actions and intentions.
- **Strategy:** Link the interpretation of motion and 3D shape *as early as possible* in visual processing.

Research interests

- Image databases and content-based image retrieval
- Remote sensing and geographic information systems (GIS)
- Connections to biological vision, especially colour vision





Some Research Groups in LCI

- Adaptive Interfaces, Natural Language Processing, Haptics
- Machine Learning, Game Theory and Multi-Agent Systems
- Computational Vision, Robotics and Constraint-based Systems



Some LCI Grad Courses

- Image Understanding and Computer Vision
- Machine Learning
- Multi-agent Systems and Game Theory
- Artificial Intelligence
- Computational Linguistics
- Optimal Decision Making and Control
- Bayesian Inference and Monte Carlo Simulation
- Intelligent User Interfaces
- Sensory-motor computation



Join LCI: the world's best AI lab!



- Great projects
- Great people
- Sense of scientific adventure
- Support for the risky and new
- Good infrastructure
- Fun!