

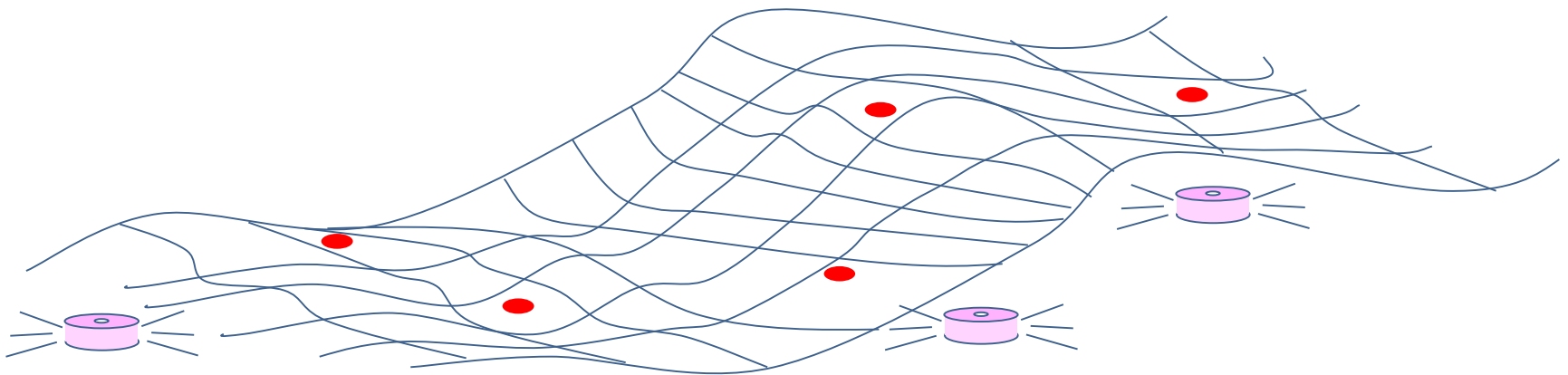
Predictions, Decisions, and Intelligence in the Open World

Eric Horvitz
Microsoft Research

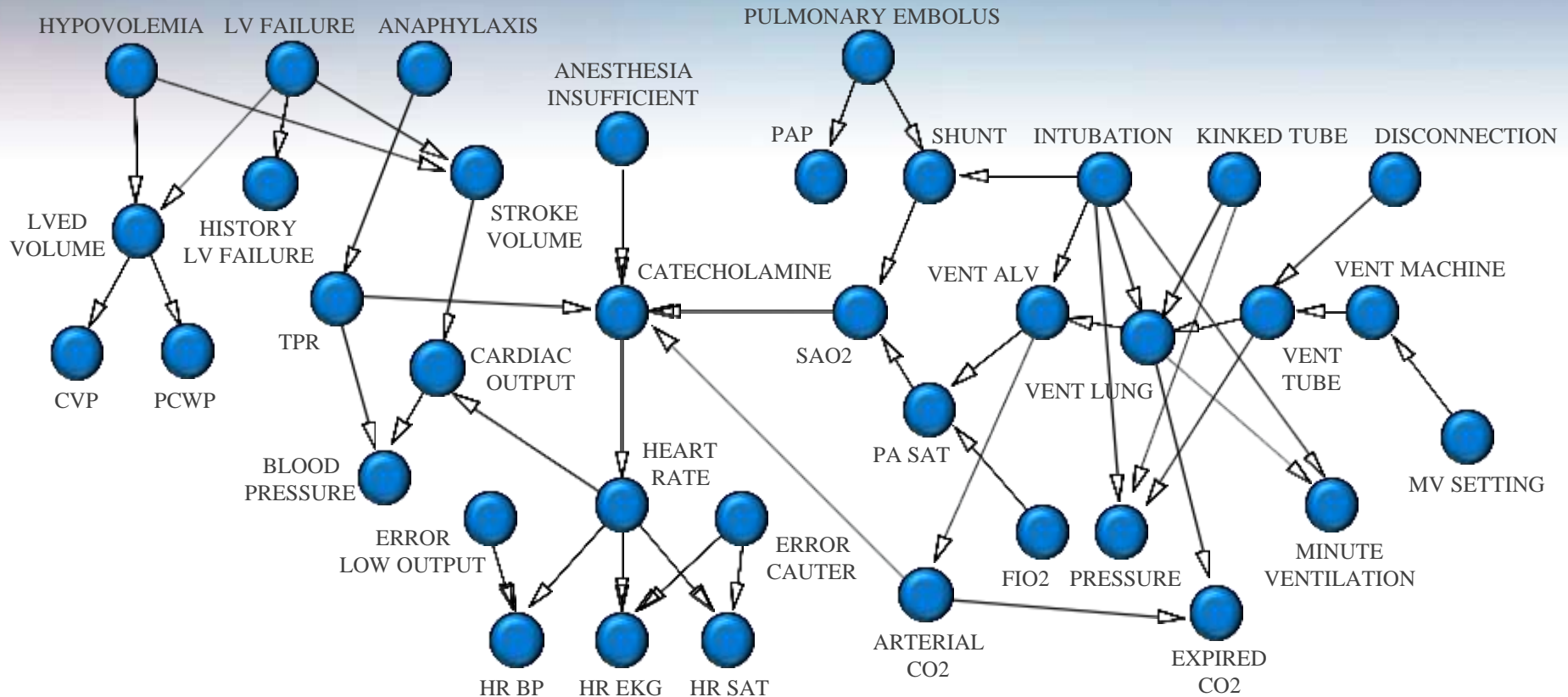
Exciting Times

- ↑ Computation & memory
- ↑ Data & connectivity
- ↑ Learning & reasoning prowess

Opportunities & directions

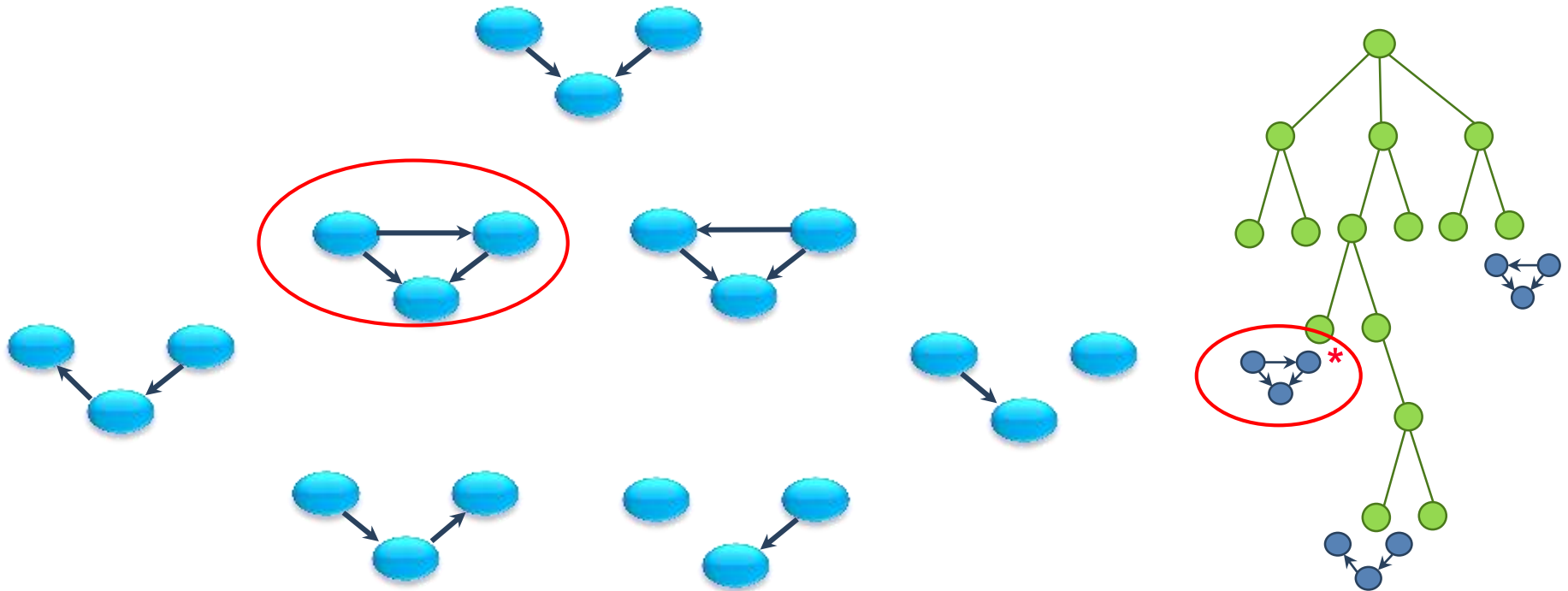


Advances in Representation & Reasoning



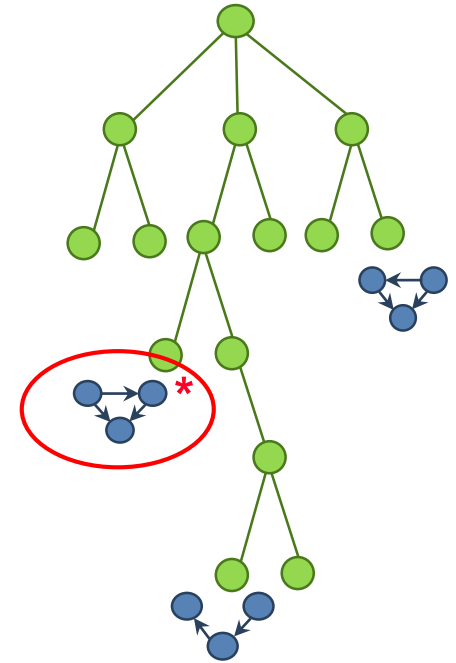
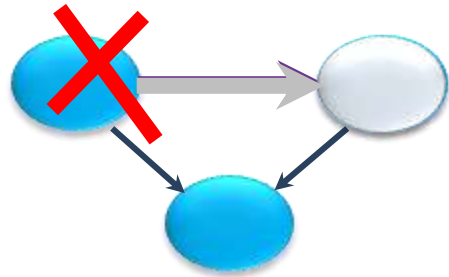
Learning Models from Data

- New access to large amounts of data
- Procedures for learning predictive models



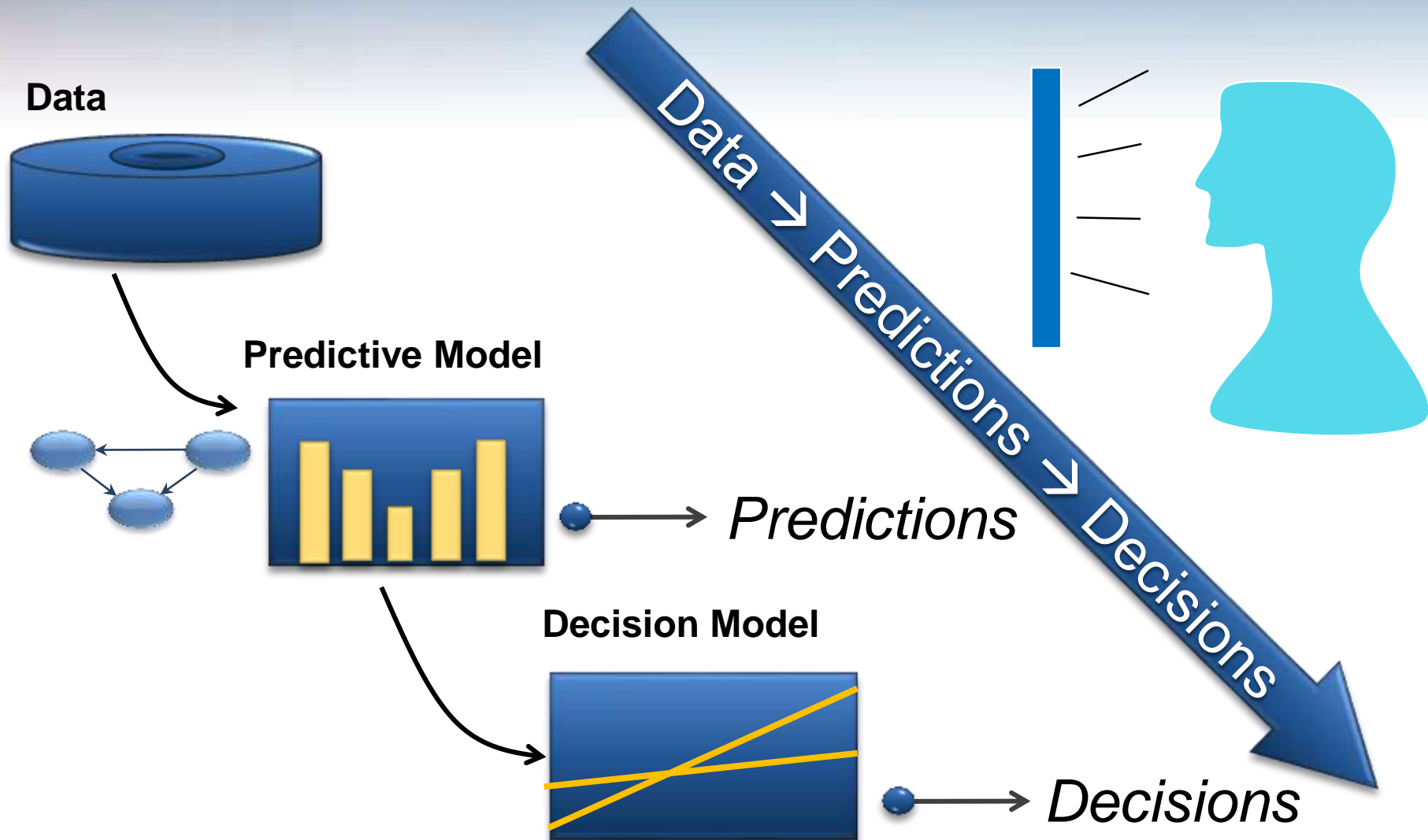
Causality & Hidden Variables

- Causality from observations (sometimes)

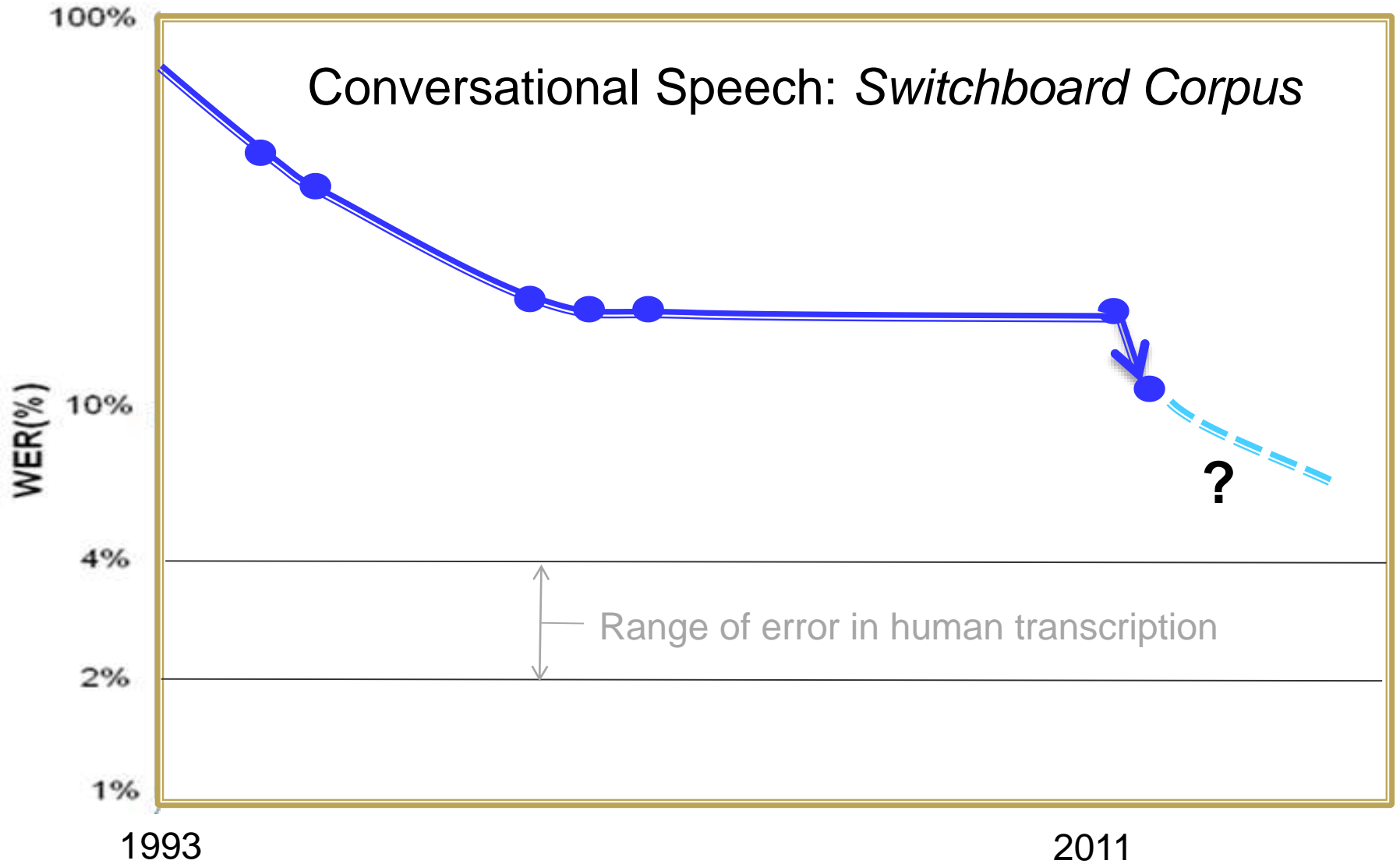


Data → Predictions → Decisions

- Best actions under uncertainty



Exciting Directions

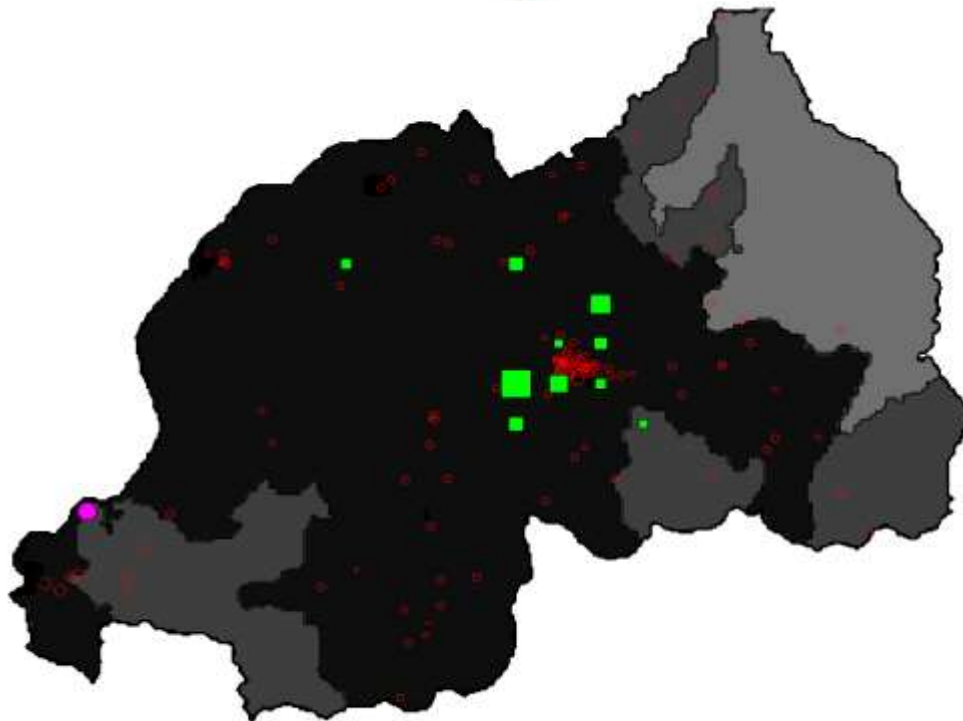


Exciting Directions

Ambient, "in-stream" data resources

Example: *Lac Kivu* earthquake, Congo

Rwandan call densities: 6 days, 140 towers, 10.5m calls



Behind the Scenes... in Daily Life

Learning & prediction in daily use

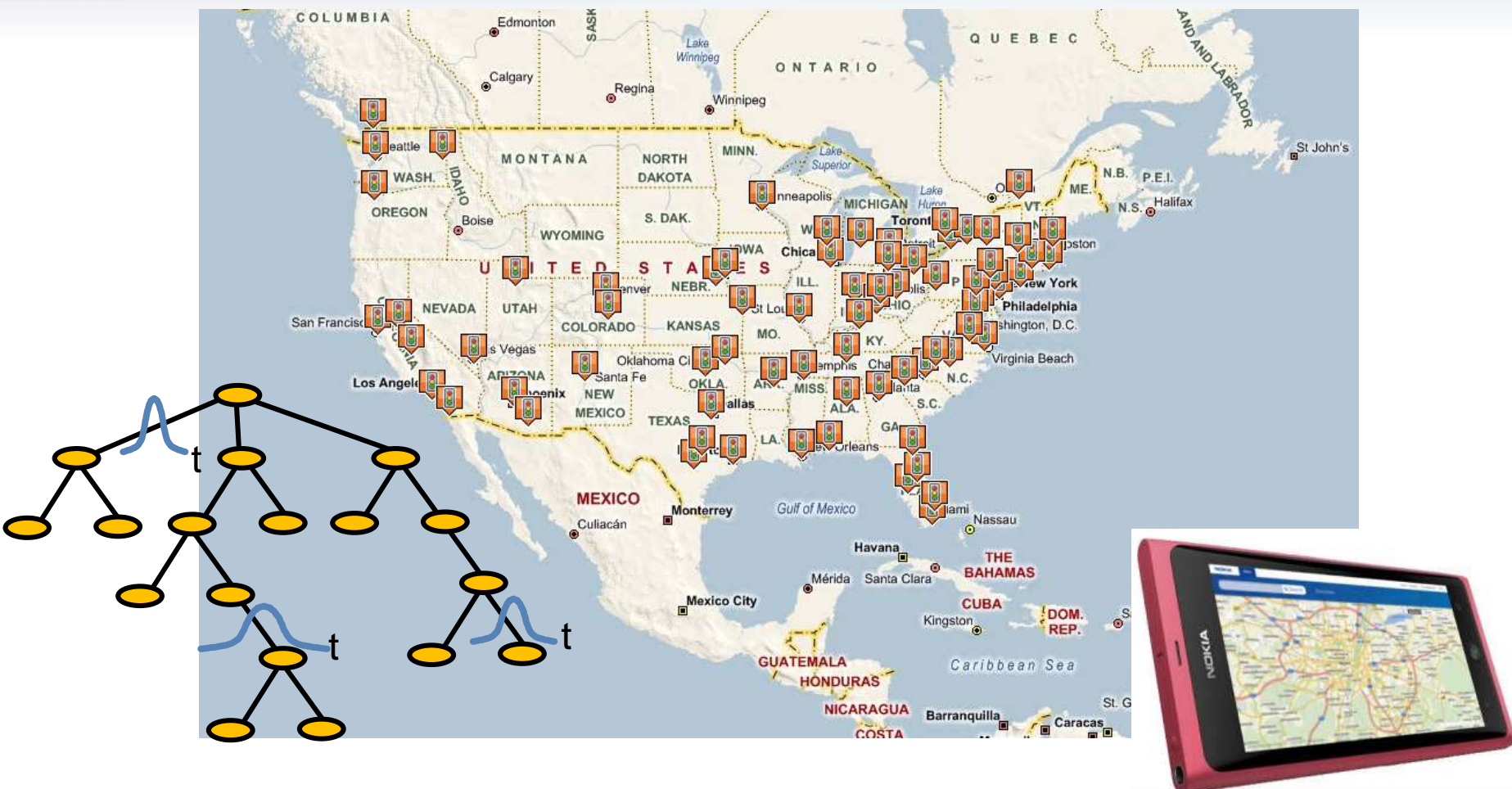
- Desktop ...and on the go
- In car
- Living room

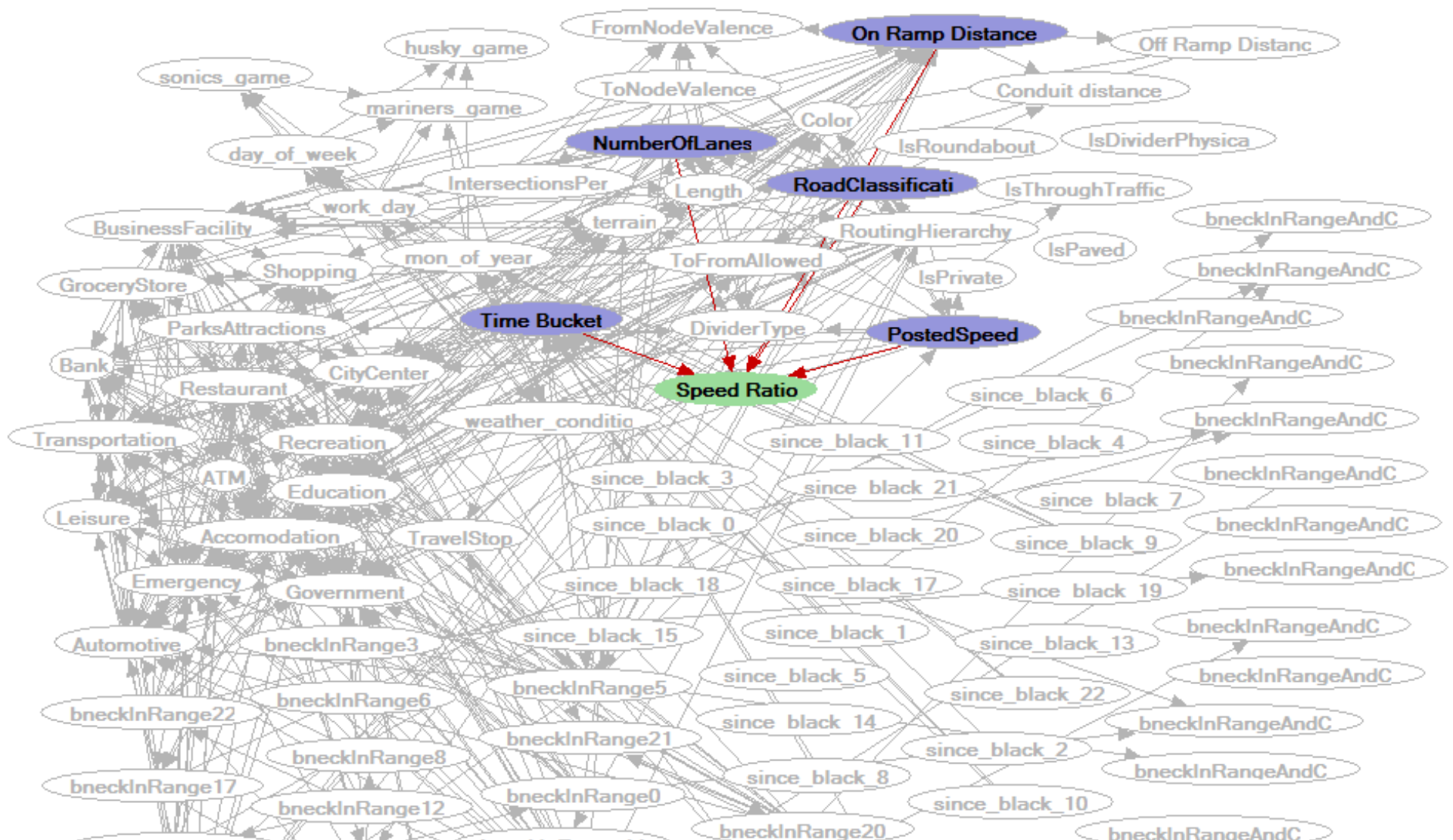
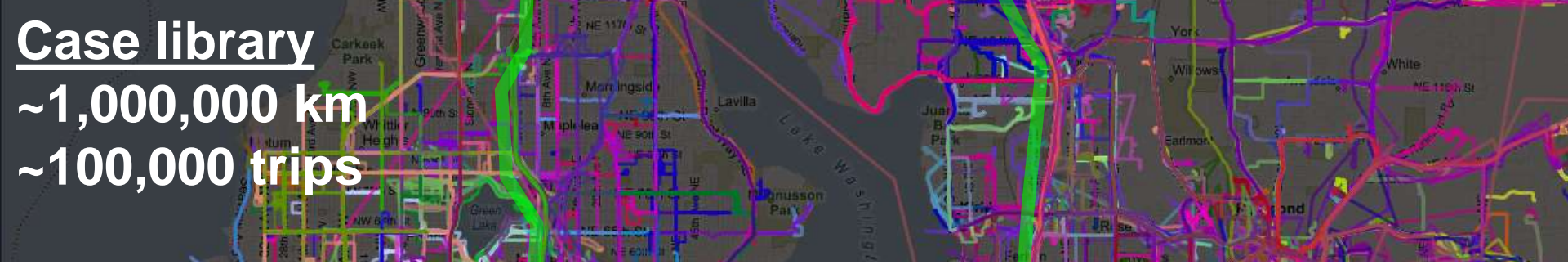
Time Period	TOP4	TOP3	TOP2	TOP1	Number of app launches
Weekdays (WD)	89.62%	85.06%	77.02%	60.51%	90,073,391
Weekends (WE)	92.25%	87.99%	79.99%	62.87%	31,447,609
WD 6pm-12am	92.91%	89.00%	81.10%	63.33%	28,823,389
WD 12pm-6pm	92.76%	88.78%	80.84%	62.99%	24,631,593
WD 6am-12pm	93.17%	89.39%	81.61%	63.47%	14,697,524
WE 12pm-6pm	94.93%	91.35%	83.61%	65.55%	7,575,714
WE 6pm-12am	94.96%	91.34%	83.52%	65.28%	7,338,829
WD 12am-6am	94.65%	91.26%	84.00%	66.18%	5,537,338
WE 6am-12pm	95.53%	92.30%	85.02%	67.05%	3,437,670
WE 12am-6am	96.01%	92.87%	85.84%	68.64%	1,663,091
					121,521,000 Total launches

Bing Traffic-Sensitive Routing

maps.bing.com * m.bing.com

- 72 cities across North America
- Flows assigned to ~60 million streets *every few minutes*





Bing Traffic-Sensitive Routing

Bing Maps - Windows Internet Explorer

http://www.bing.com/maps/default.aspx?q=directions&mk= en-US&FORM=BYFD#Y3A9NDcuNjk2ODEzNzM1NDIzNTk2f0xMjluMjY2MTMyMDAwMDAwMDMmbHZzPTEzJnN0eT1yJnJk

File Edit View Favorites Tools Help

★ Favorites | Robert and Ana-Maria M... AT ATuse BoA MSTrav Perform Tw 23 PAP EH B Bing News GSHL MSNBC FB GN G Suggested Sites

Resnet camaraderie - Google Sear... msft - Google Search Bing Maps

Web Images Videos Shopping News Maps More | MSN Hotmail

bing directions

Maps Web Videos Images Maps

Directions My places Map apps Road Bird's eye Traffic

Edit route

World • United States • WA • King Co.

Route: 13.1 miles, 35 min
(rerouted based on traffic)
Go back to the previous route

11300 Roosevelt Way NE, Seattle, WA
98125-6228

- 1 Depart Roosevelt Way NE toward NE 113TH St 0.2 mi
- 2 Turn left onto NE Northgate Way ARCO/ampm on the corner 0.9 mi
- 3 Bear left onto WA-522 / Lake City Way NE 4.7 mi
Pass Taco Bell in 1.7 mi
- 4 Turn right onto 68TH Ave NE 0.5 mi
- 5 Road name changes to Juanita Dr NE 3.8 mi
Pass 76 in 1.7 mi
- 6 Keep right onto NE Juanita Dr 1.5 mi
- 7 Turn right onto 98TH Ave NE 0.7 mi
76 on the corner

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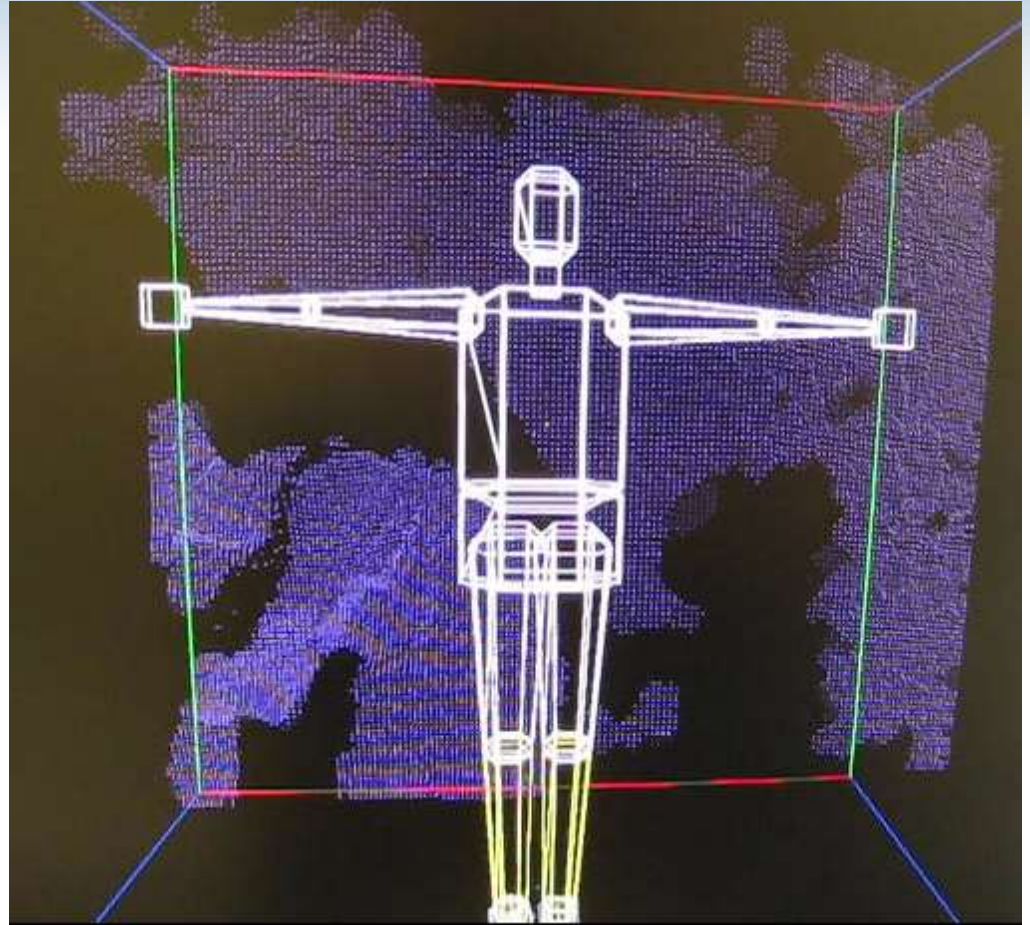
Done Internet | Protected Mode: On

And into the Living Room...



KINECT™
for  XBOX 360.

Pursuing Consumer-Centric Robustness



Shotton, J., Fitzgibbon, A. ; Cook, M. ; Sharp, T. ; Finocchio, M. ; Moore, R. ; Kipman, A. ; Blake, A.

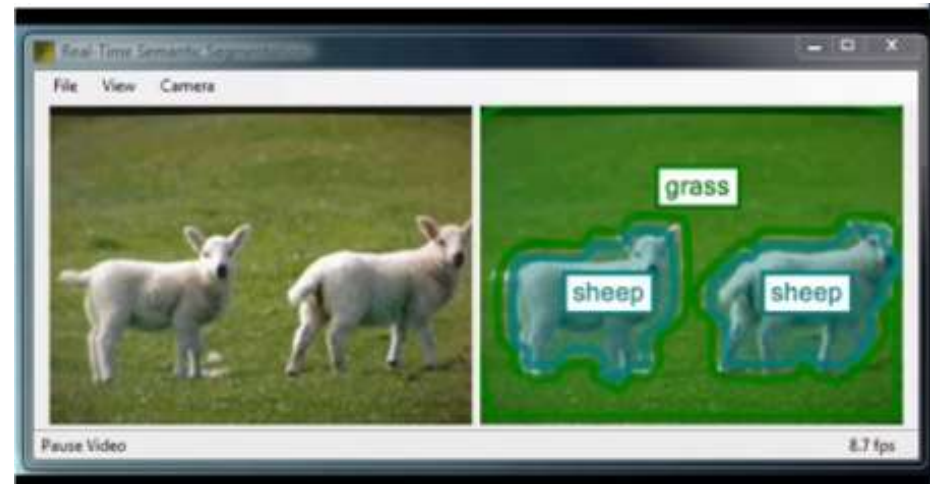
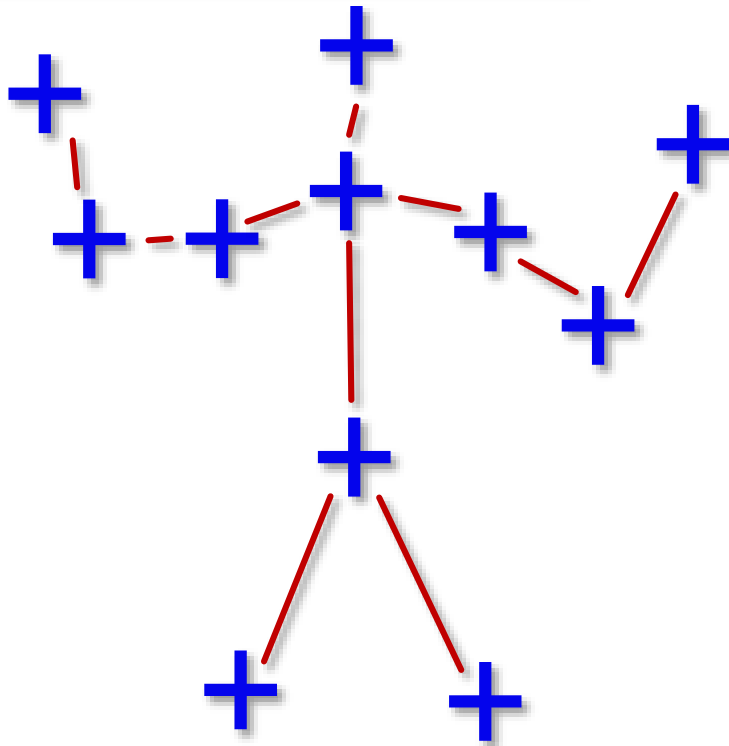
Pursuing Consumer-Centric Robustness

Prior work on segmentation & object recognition



Pursuing Consumer-Centric Robustness

Prior work on segmentation & object recognition



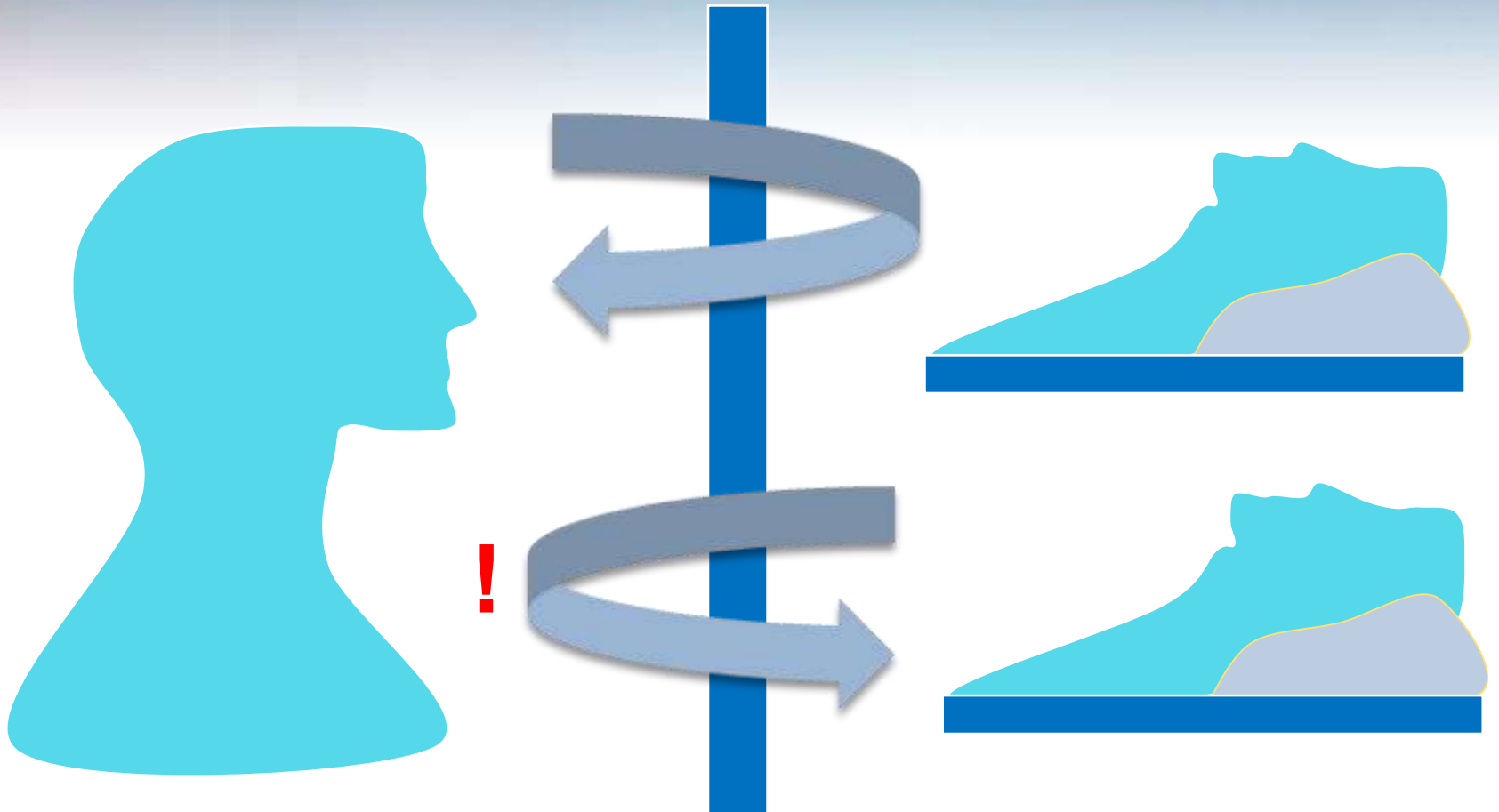
Several Directions

- Healthcare
- Complementary computing
- Integrative intelligence

Focus: Healthcare



Predicting Readmission



Readmissions Challenge



The NEW ENGLAND
JOURNAL of MEDICINE

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Volume 360:1418-1428

[April 2, 2009](#)

Number 14

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Rehospitalizations among Patients in the Medicare Fee-for-Service Program

Stephen F. Jencks, M.D., M.P.H., Mark V. Williams, M.D., and Eric A. Coleman, M.D., M.P.H.

ABSTRACT

Background Reducing rates of rehospitalization has attracted attention from policymakers as a way to improve quality of care and reduce costs. However, we have limited information on the frequency and patterns of rehospitalization in the United States to aid in planning the necessary changes.

Methods We analyzed Medicare claims data from 2003–2004 to describe the patterns of

- **~20% within 30 days**

- **~35% in 90 days**

- **Estimated cost to Medicare in 2004:
\$17.4 billion**

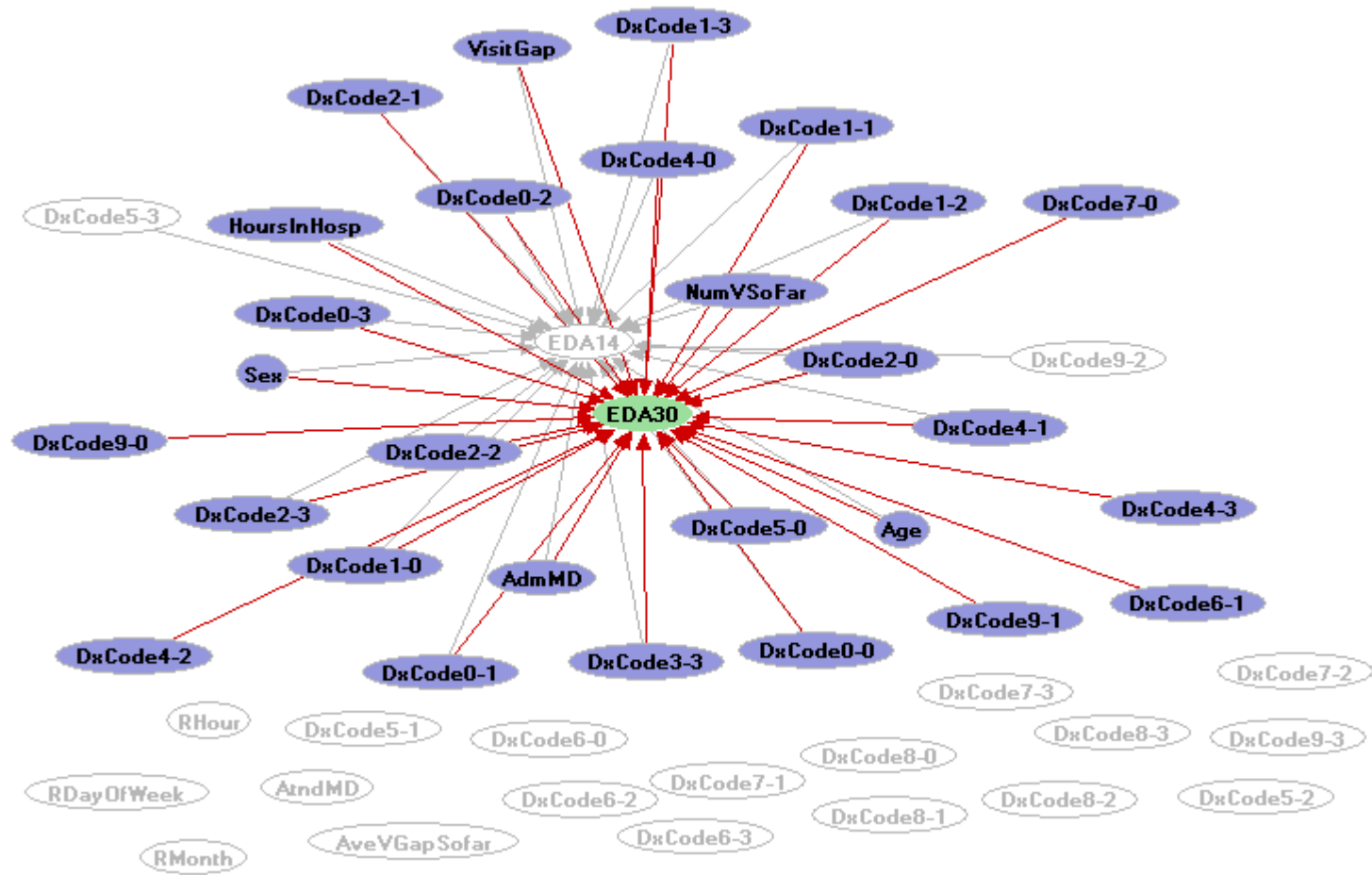
Learning from a Case Library

- Washington Hospital Center (Wash DC)
- All visits during the years 2001 to 2009 (e.g., ~300,000 ED visits)
 - Admissions, discharge, transfer (ADT)
 - Chief complaint in free text
 - Age, gender, demographics
 - Diagnosis codes (ICD-9)
 - Lab results and studies
 - Medications
 - Vital signs
 - Procedures
 - Locations in hospital
 - Admitting and attending MD codes
 - Fees and billing

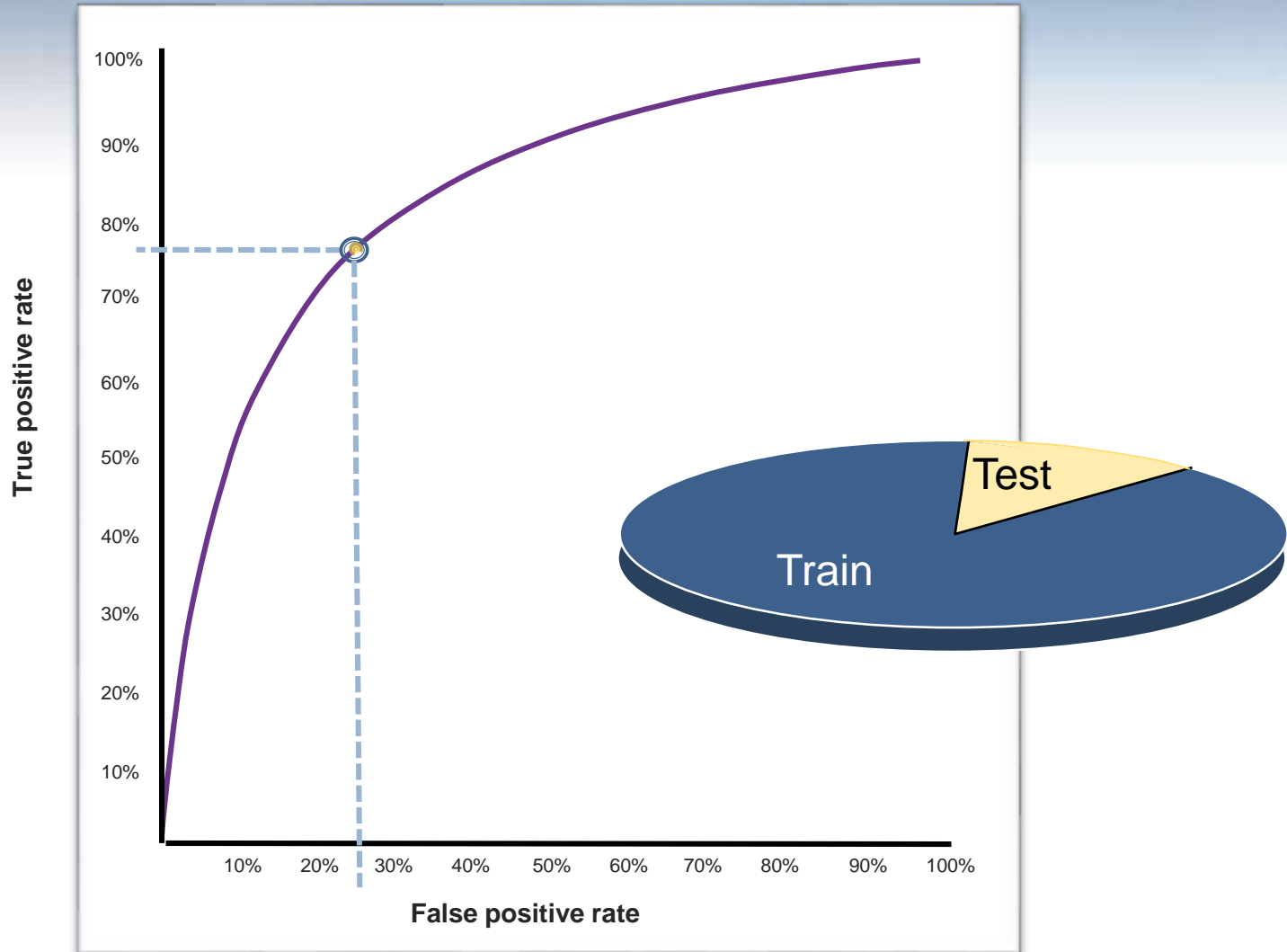


~25,000 variables considered in dataset

Building a Predictive Model for Readmission



Performance of Classifier for Readmission



Identifying Evidential Relevance

Weight	Feature description	Frequency
0.68398	Dx0->2 = Excessive vomiting in pregnancy	0.31%
0.61306	Dx3->2 = Personal history of malignant neoplasm	0.28%
0.58281	Dx0->2 = Heart failure	0.30%
0.56708	Dx0->1 = Nephritis, nephrotic syndrome, and nephrosis	0.09%
0.56649	Dx3->2 = Heart failure	0.28%
0.54663	Complaint sentence contains "suicidal"	0.17%
0.48415	Dx1->2 = Disorders of function of stomach	0.07%
0.47257	Dx5->0 = Diseases Of The Genitourinary System	0.15%
0.46136	Dx0->2 = Chronic airway obstruction, not elsewhere classified	0.10%
0.44555	Dx4->2 = Depressive disorder, not elsewhere classified	0.10%
0.44257	Stayed 14 hours in the ER	0.10%
0.43890	Dx0->1 = Other psychoses	0.32%
0.43513	Dx0->0 = Diseases Of The Blood And Blood-Forming Organs	0.46%
0.42582	Complaint sentence contains "dialysis"	0.19%
0.41888	Dx0->2 = Depressive disorder, not elsewhere classified	0.27%
0.41302	Dx1->1 = Nephritis, nephrotic syndrome, and nephrosis	0.29%
0.38506	Complaint sentence contains "fluid"	0.10%
0.37474	69 < Age	9.22%

Translation: Research → Open World

Readmissions Manager for Microsoft Amalga

Reducing Hospital Readmissions is an Impending Priority

Overview

One in five Medicare inpatients is readmitted within 30 days. The Centers for Medicare and Medicaid Services (CMS) considers 40%-75% of these readmissions to be preventable.

In October 2012, CMS will begin to track readmission and impose financial penalties on hospitals with higher-than-expected readmission rates for certain conditions. Other payers will certainly follow.

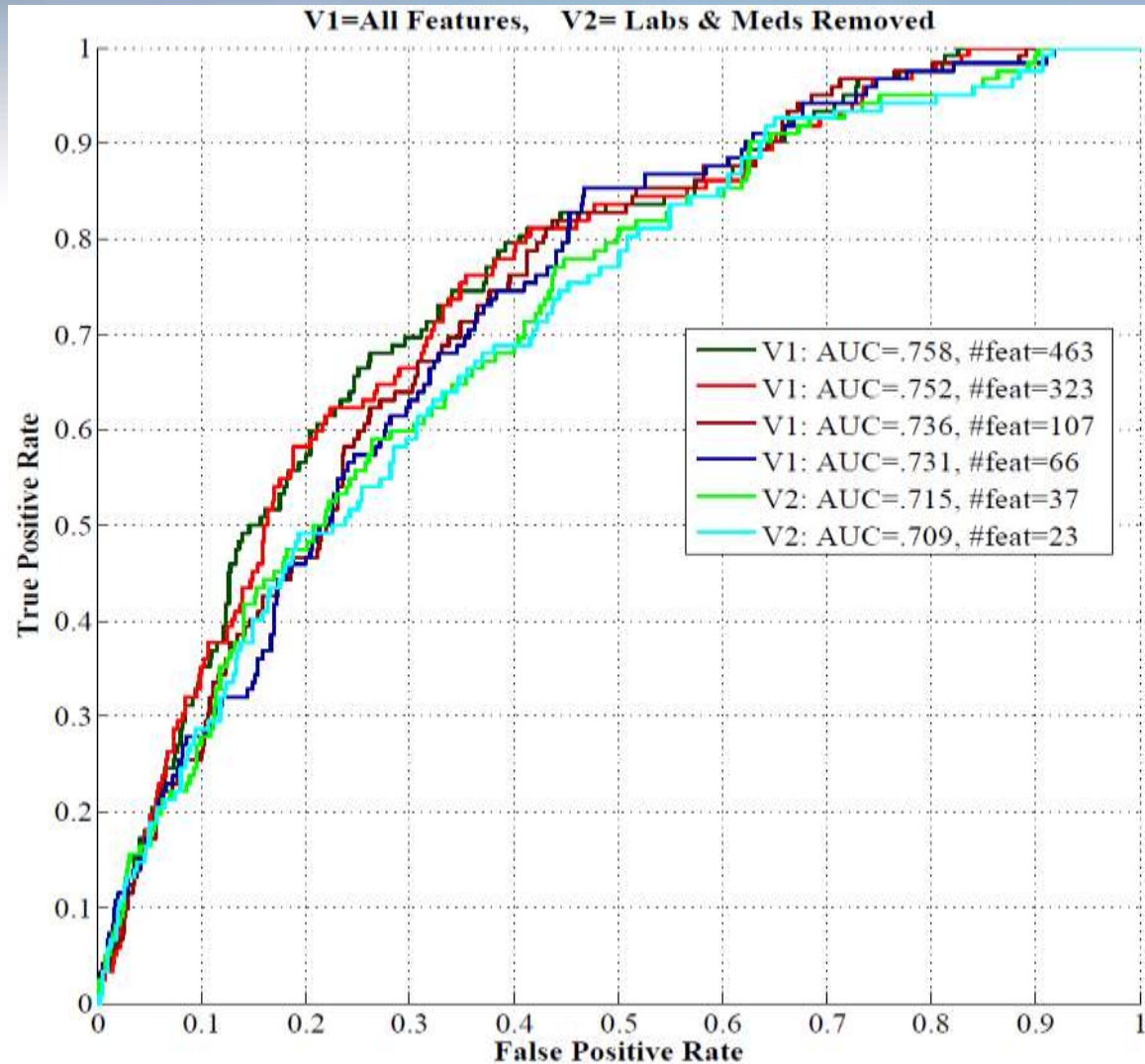
It is clear that hospital admissions and readmissions are becoming a critical parameter for tracking care delivery from both a financial and quality perspective.

Readmissions Manager for Microsoft Amalga is an innovative solution to help organizations address this very important business need.



Readmissions Manager Targets Avoidable Hospital Readmissions

Engineering Real-World Solutions



Predictive Platform goes live...

Microsoft Amalga - recazang



US - Sample Hospital

M3L Inp/Inp Readmission Prediction Last...

Filter

Sort

Shortcut

Find

Zoom-in

Refresh

System ▾

None ▾

All ro...

Dev

Data Mining

Info

Input

Forms

Admin

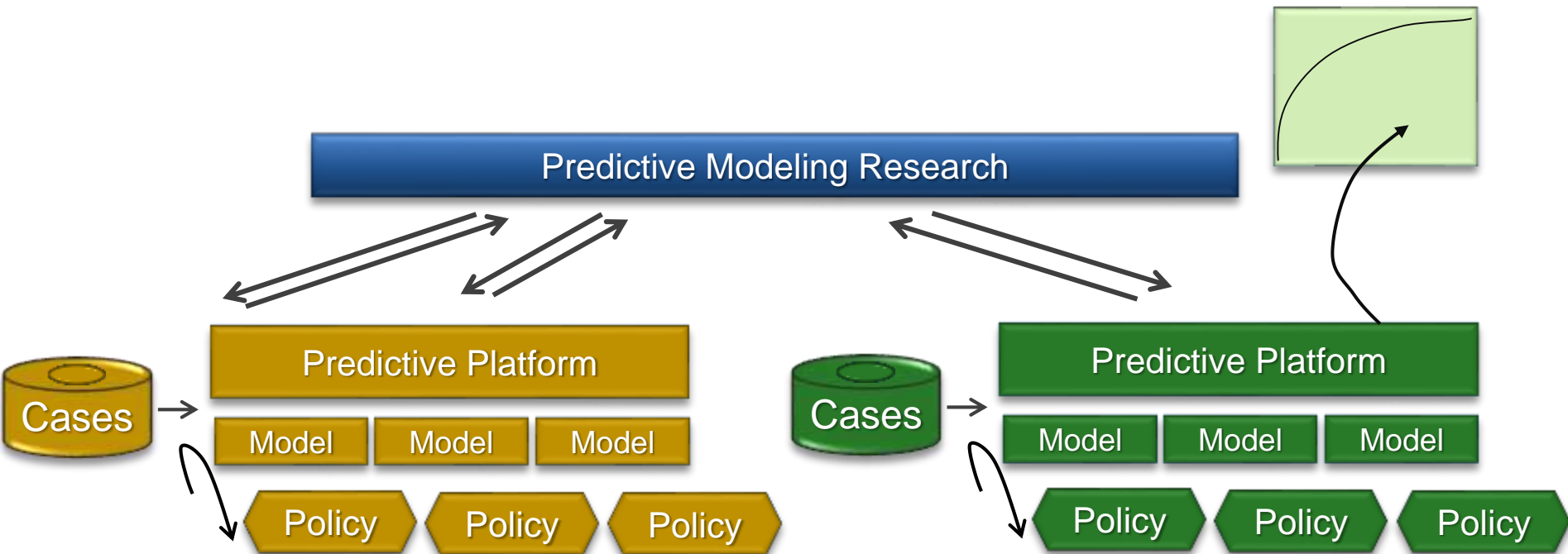
Dashboard

New Task

ACCOUNT	ADMITDTTM	DISCHARGEDTTM	AGE	SEX	PROB_NUM_% ▲	FACTOR
	12/03/2010 14:57	12/08/2010 18:03	62	F	37.9	Num past 6m visits = 6 to 10 / P
	12/08/2010 18:45	12/08/2010 18:45	74	M	32.72	stayed <1 day in the hospital / Pa
	11/16/2010 16:14	12/08/2010 18:50	48	M	30.83	Patient had dx = Chronic renal fa
	12/02/2010 13:49	12/08/2010 18:14	68	M	29.05	Patient had dx = Disorders of flui
	12/01/2010 05:26	12/08/2010 18:55	44	M	28.54	
	12/01/2010 19:08	12/08/2010 18:13	61	M	27.36	Patient had dx = Acute renal failu
	11/30/2010 21:50	12/08/2010 18:52	70	M	18.05	Patient had dx = Other personal
	12/08/2010 08:51	12/08/2010 18:45	68	M	16.57	stayed <1 day in the hospital
	12/03/2010 20:32	12/08/2010 17:50	80	M	16.18	Patient had dx = Disorders of flui
	12/01/2010 01:13	12/08/2010 18:06	79	M	15.52	
	12/08/2010 18:39	12/08/2010 18:39	22	F	14.53	stayed <1 day in the hospital / Av
	12/08/2010 19:01	12/08/2010 19:01	25	F	14.42	stayed <1 day in the hospital / Pa
	12/08/2010 18:05	12/08/2010 18:05	24	M	14.39	stayed <1 day in the hospital
	12/08/2010 18:26	12/08/2010 18:26	53	F	13.59	stayed <1 day in the hospital / 44

Learning from In-World Experiences

- Automation ↔ expert handholding?
- Data differences → universal schema
- Cross-site learning & sharing



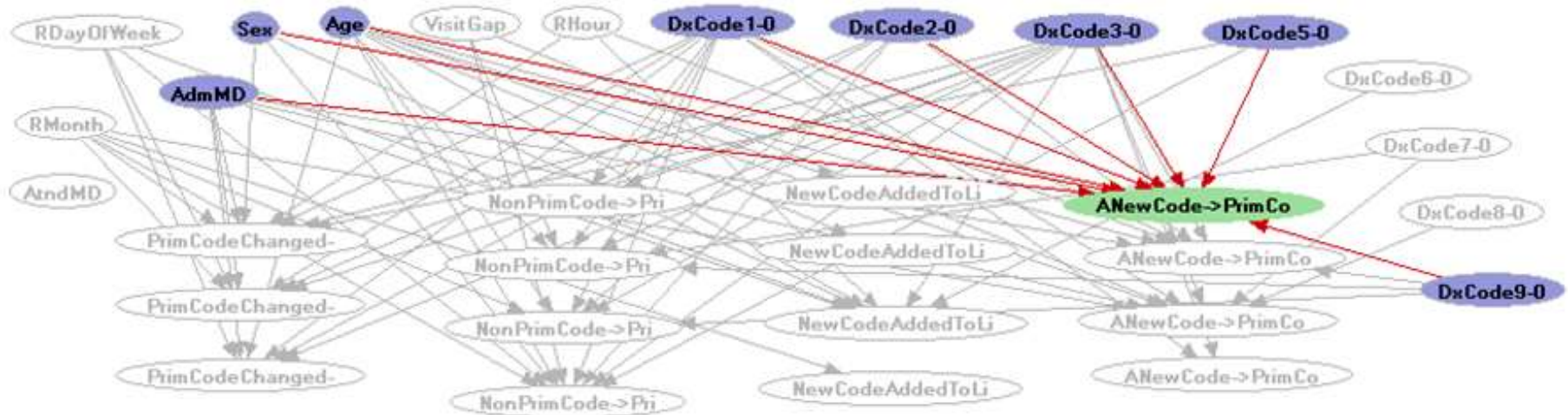
Predictions from Clinical Data

- ED discharge → Inpatient within 72 hrs, 30 days
- Inpatient discharge → Inpatient within 30 days
- CHF discharge → CHF inpatient within 30 days
- Inpatient → infection within 48hrs, 72hrs, stay
- Death within 30 days
- New kinds of models: Surprise

Surprise Model for Clinical Care

- Predict surprising outcomes

“The patient you’re discharging now will likely return within 3 days with a 1^o dx that is not currently on the chart.”

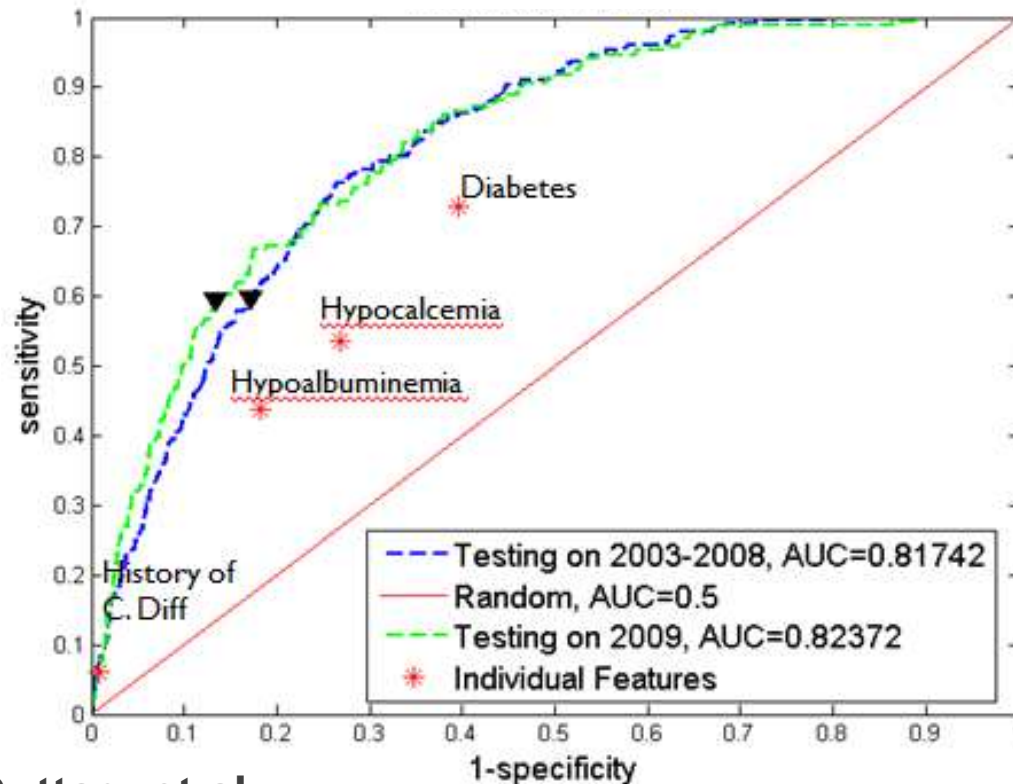


Learning about Time and Space

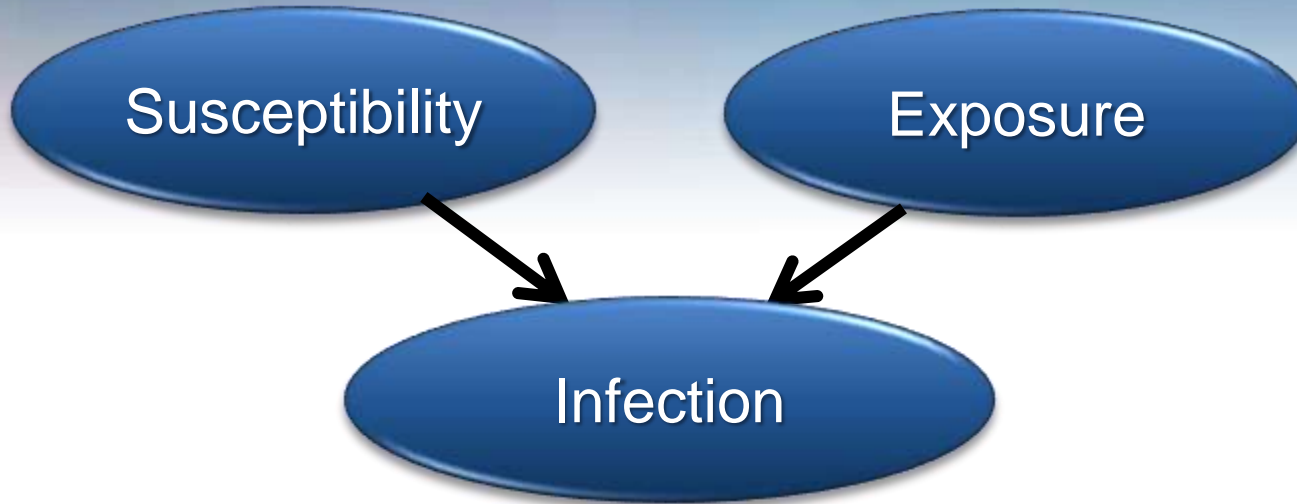
Hospital-Associated Infection

- 1 in 20 hospital visits, ~\$20 billion/yr.
- 5% death (top 10 cause of death in US)

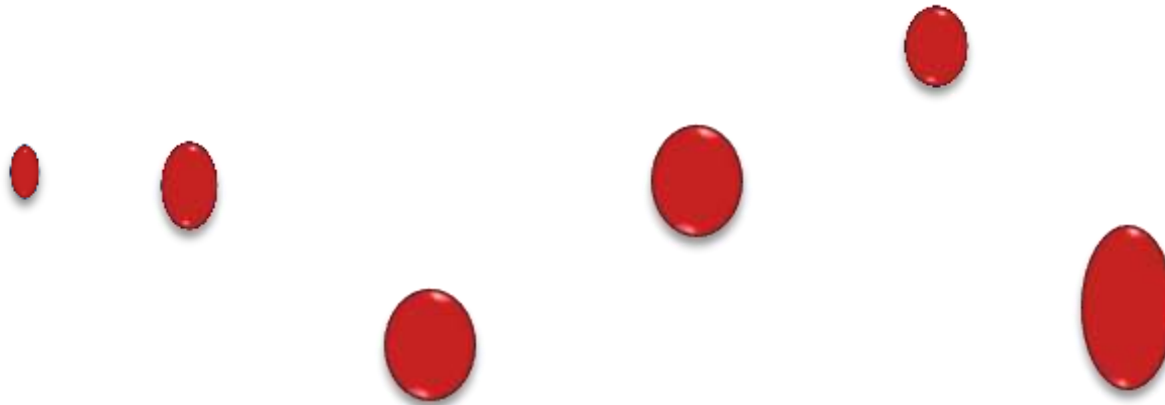
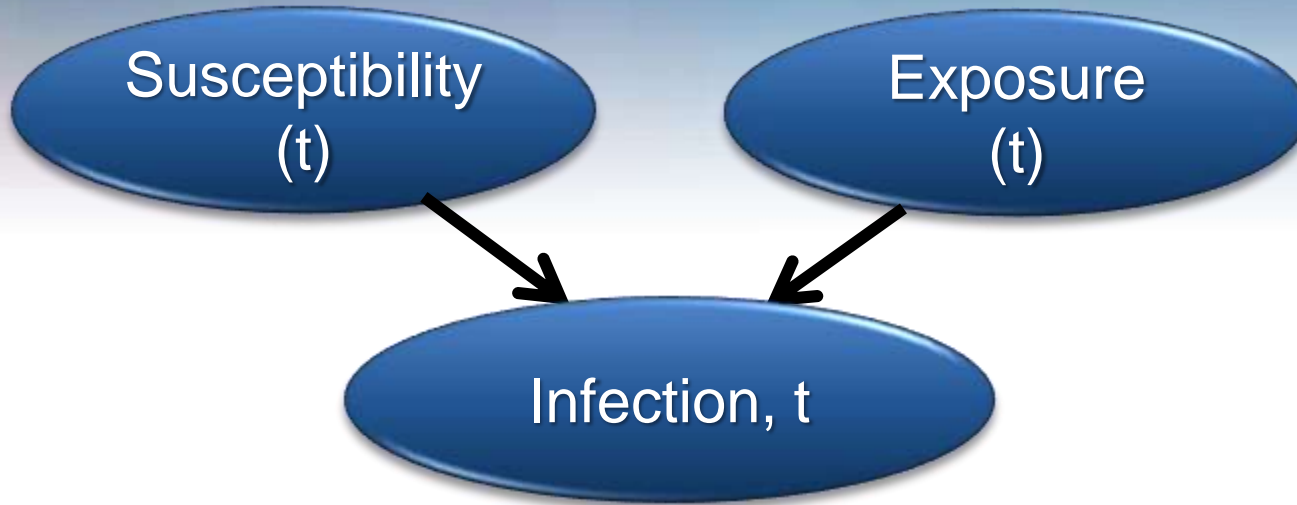
Predicting C.Difficile < 48 hrs



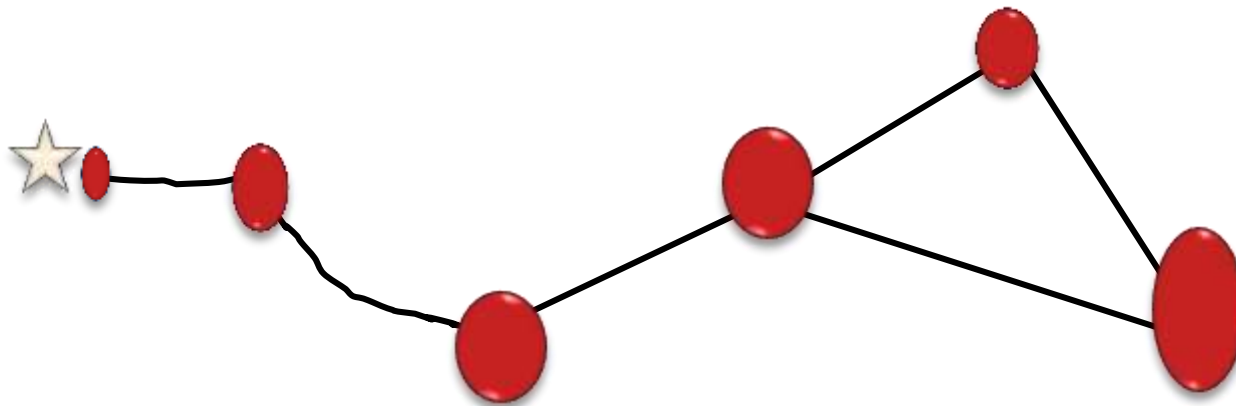
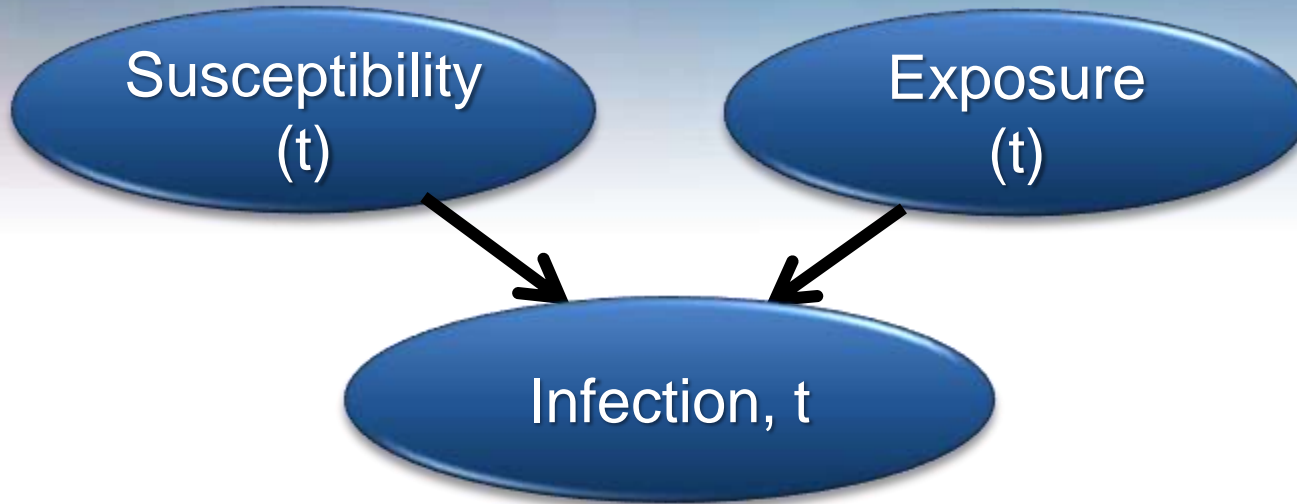
Learning about Time and Space



Learning about Time and Space

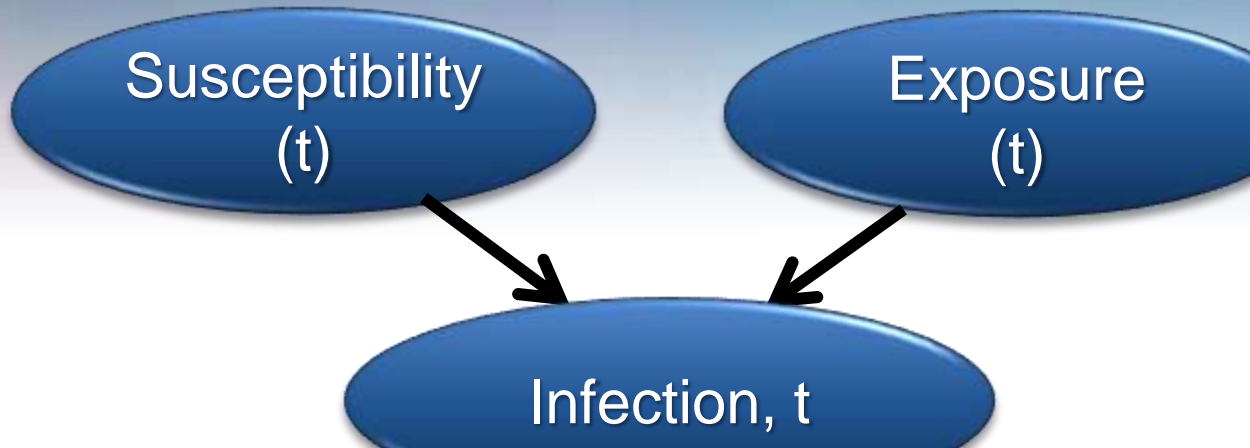


Learning about Time and Space

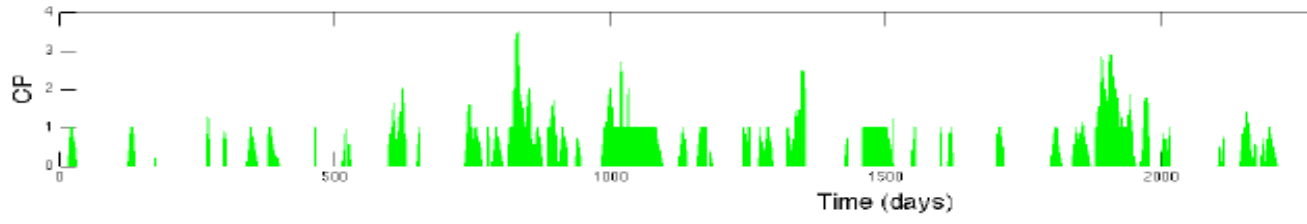
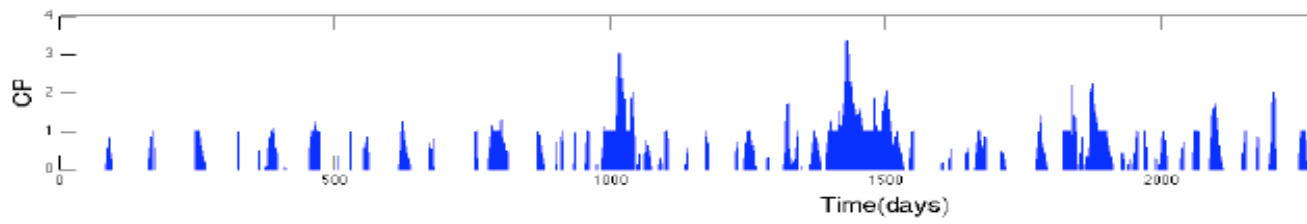
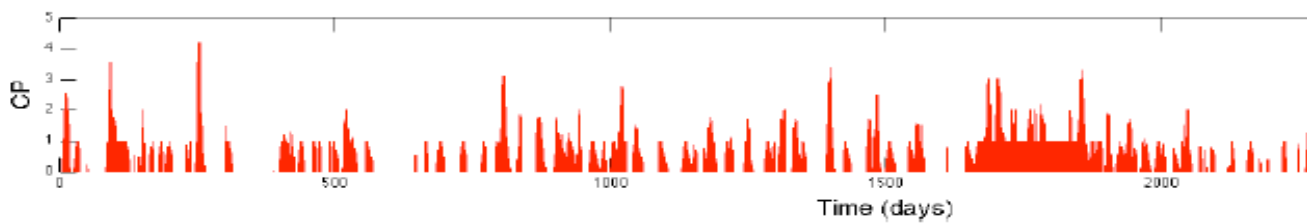


Area under curve 0.69 \rightarrow .80 [time]

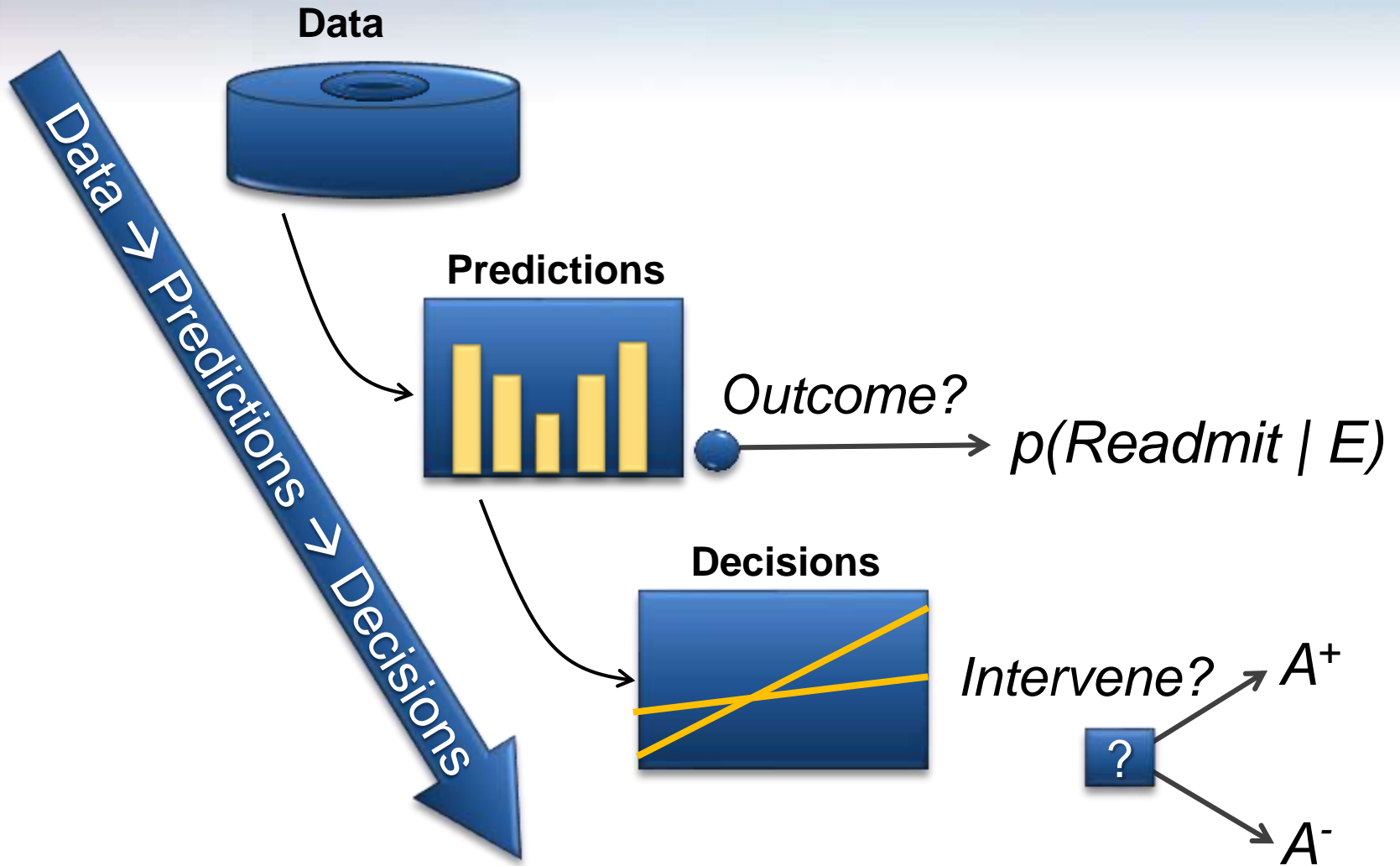
Learning about Time and Space



Location	Description
1C	Patient Care Unit
1E	Patient Care Unit
1G	MedSTAR ICU
1H	Patient Care Unit
2C	Patient Care Unit
2E	Patient Care Unit
2G	Intensive Care Unit (ICU)
2H	Patient Care Unit
2NE	Patient Care Unit
2NW	Patient Care Unit
3C	Patient Care Unit
3D	Patient Care Unit
3E	Patient Care Unit
3F	Patient Care Unit
3G	Intensive Care Unit (ICU)
3NE	Patient Care Unit
4C	Patient Care Unit
4D	Patient Care Unit
4E	Patient Care Unit
4F	Patient Care Unit
4G	Intensive Care Unit (ICU)
4H	Intensive Care Unit (ICU)
4NW	Patient Care Unit
5C	Patient Care Unit
5D	Patient Care Unit
5E	Patient Care Unit
5F	Patient Care Unit
5NE	Patient Care Unit
5NW	Patient Care Unit



Predictions → Decisions



Study: Congestive Heart Failure

- Most frequent dx for hosp. Medicare patients
 - 6–10% of folks over 65
 - \$35 billion/yr US

Decision:

Invest in post-discharge program for patient?

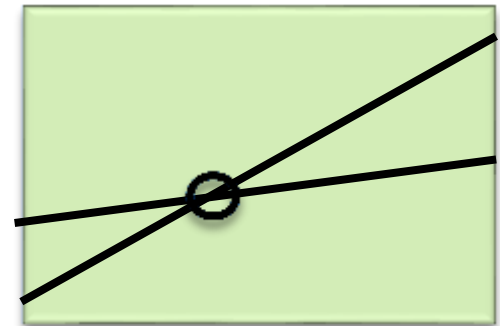
Multiple interventions proposed.



Study

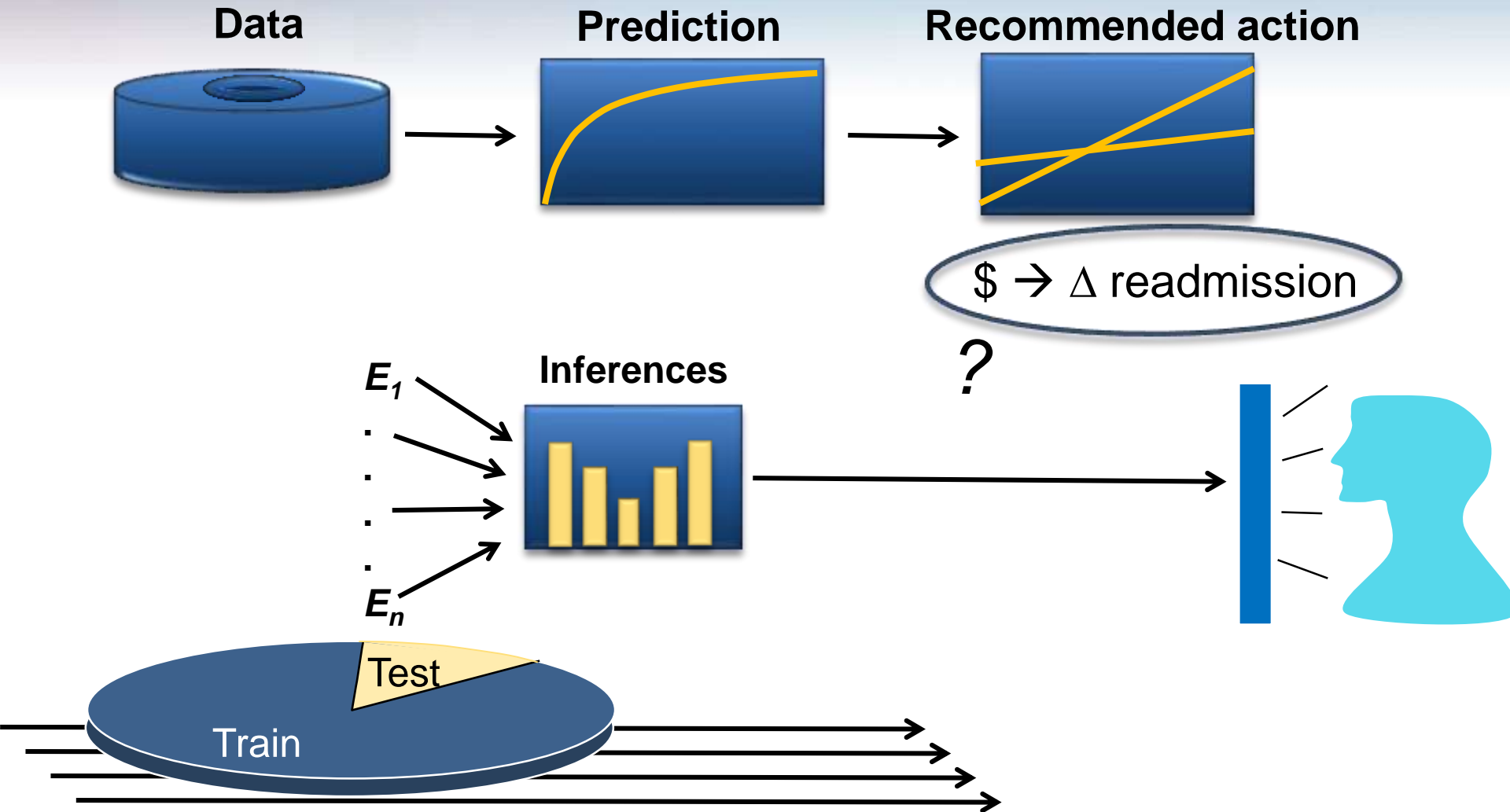
- Train: 4,485 hospitalizations for CHF, 2004-2007
- Testing: 1,319 hospitalizations for CHF, 2008
 - Mean stay: 8.4 days
 - Mean cost: \$18,435

Decision model: *Probability threshold on predicted likelihood of readmissions for enlistment in special program.*



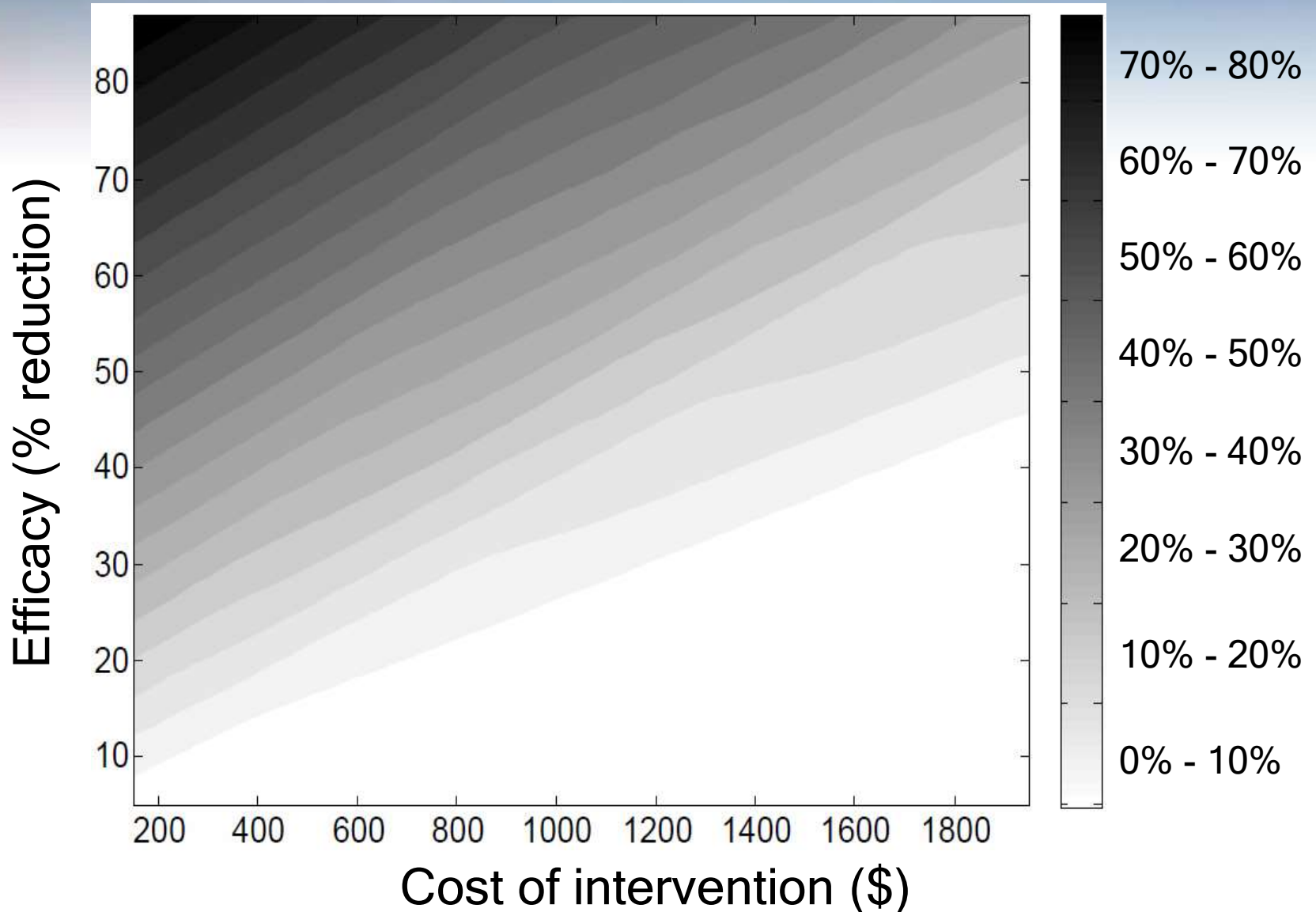
Expected Value of Decision System

- Probe the expected value of fielding a system(!)



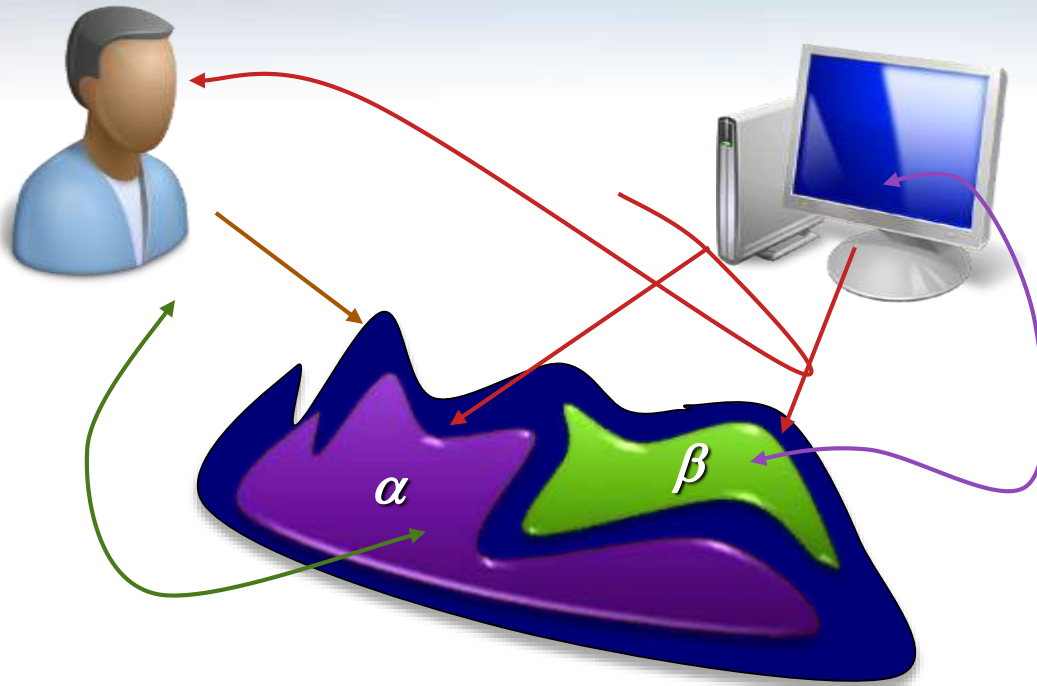
Expected Value of Fielding System

Prediction-centric action: train: 2004-2007, test: 2008



Focus: Complementary Computing

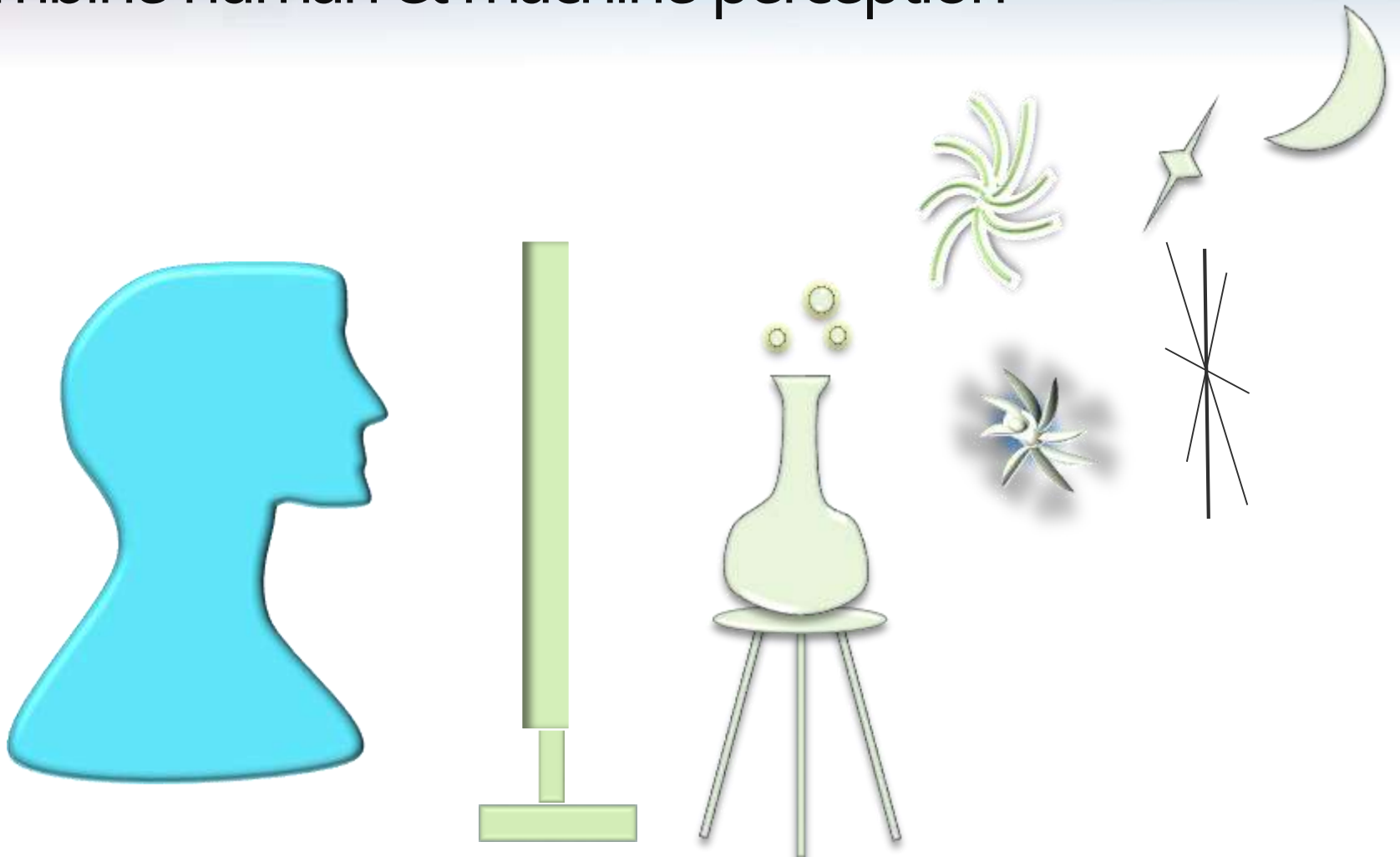
On vision of human-computer symbiosis



Machine learning & inference to leverage contributions from machine & human

Study: Citizen Science

Apply machine learning and decision making to combine human & machine perception



Galaxy Zoo: Tag Galaxies

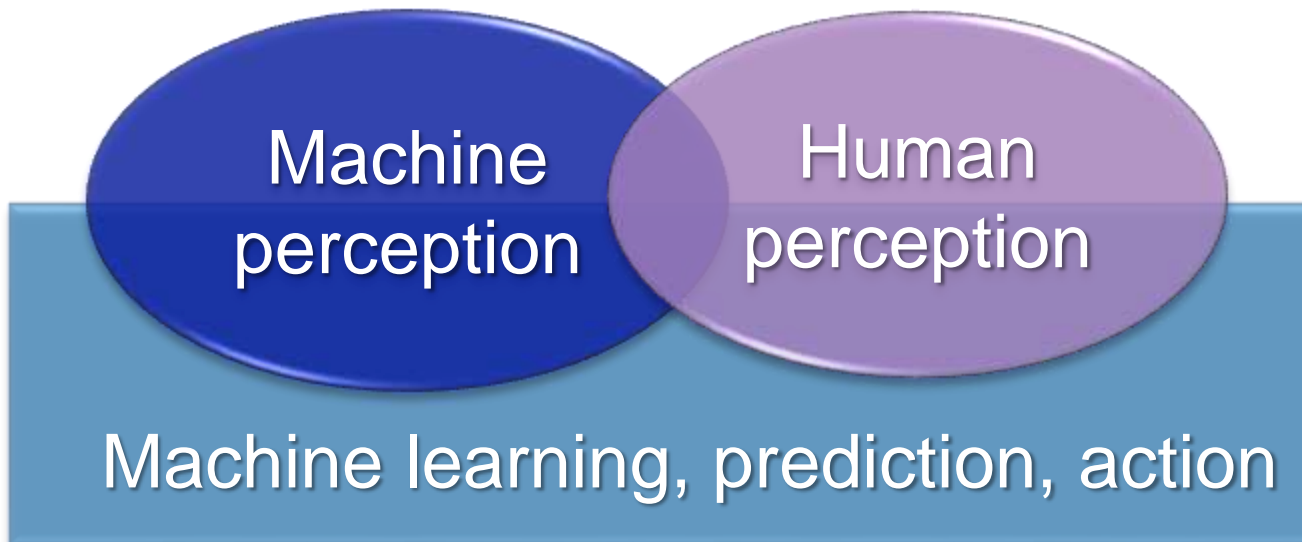
- Sloan Digital Sky Survey:
~ 10^6 galaxies, ~120k quasars, ~225k stars



Volunteer DB: 886k galaxies, 34m votes, 100k, people

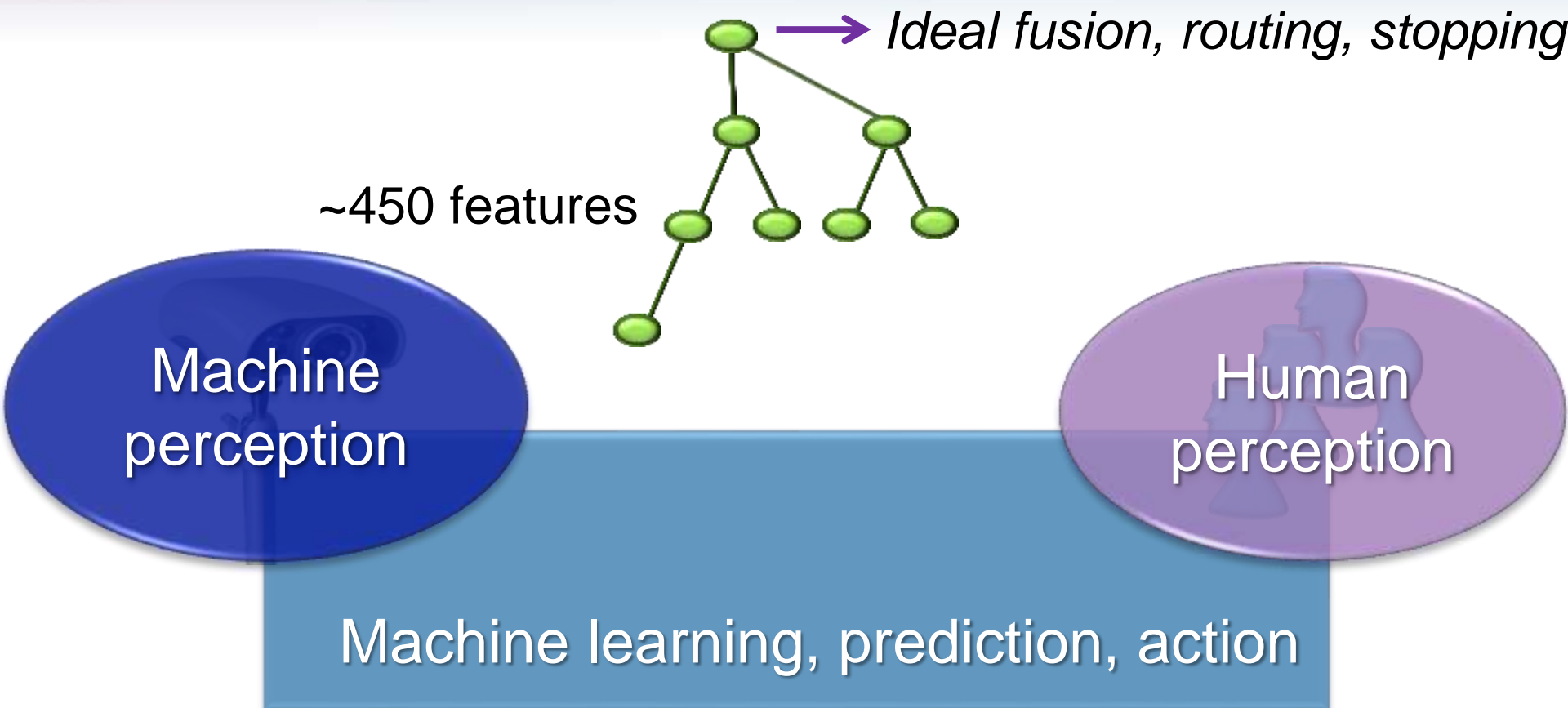
CrowdSynth

- Machine learning for fusion & task routing
- Learn from machine vision & votes



CrowdSynth

- Machine learning for fusion & task routing
- Learn from machine vision & votes

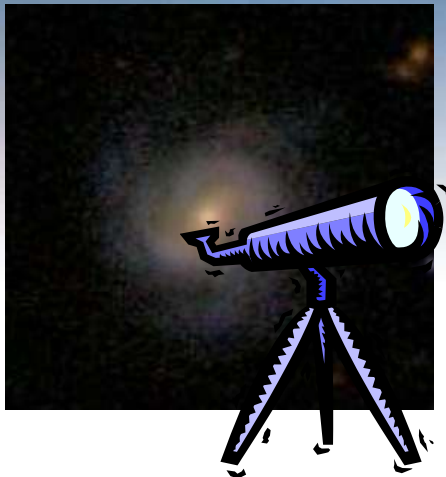


Sloan Digital Sky Survey

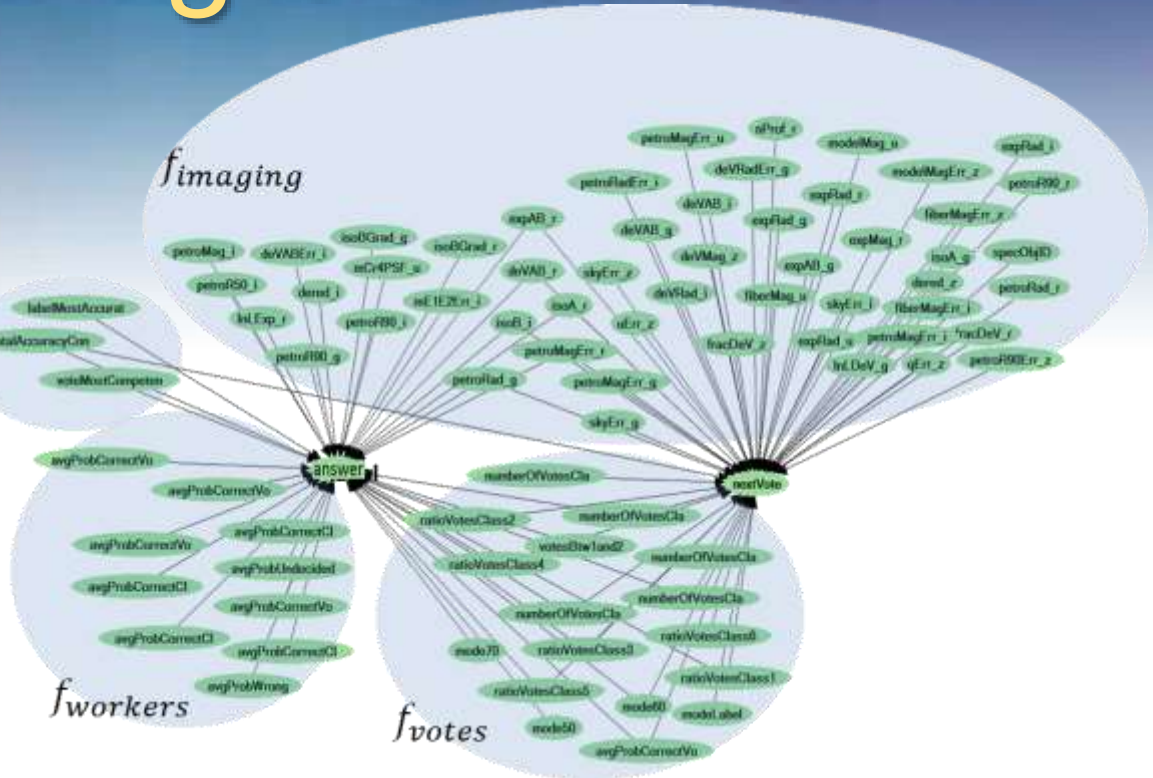
453 features

Attribute	Description
$petroMag_{ug}$	Petrosian magnitude colors. A color was calculated for four independent pairs of bands in SDSS (u, g, r, i, z).
$petroRad_u * z$	Petrosian radius, transformed with redshift to be distance-independent.
$invConIndx_u$	Inverse concentration index. The ratio of the 50% Petrosian magnitude to the 90% Petrosian magnitude.
$isoRowcGrad_u * z$	Gradient of the isophotal row centroid, transformed with redshift to be distance-independent.
$isoColcGrad_u * z$	Gradient of the isophotal column centroid, transformed with redshift to be distance-independent.
$isoA_u * z$	Isophotal major axis, transformed with redshift to be distance-independent.
$isoB_u * z$	Isophotal minor axis, transformed with redshift to be distance-independent.
$isoAGrad_u * z$	Gradient of the isophotal major axis, transformed with redshift to be distance-independent.
$isoBGrad_u * z$	Gradient of the isophotal minor axis, transformed with redshift to be distance-independent.
$isoPhiGrad_u * z$	Gradient of the isophotal orientation, transformed with redshift to be distance-independent.
$texture_u$	Measurement of surface texture.
$lnLExp_u$	Log-likelihood of exponential profile fit.
$lnLDeV_u$	Log-likelihood of De Vaucouleurs profile fit.
$fracDev_u$	Fraction of the brightness profile explained by the De Vaucouleurs profile.

Machine Learning for Prediction



Task features



Vote features

- **Object model** assesses likelihood of world state
- **Vote model** predicts worker assessments

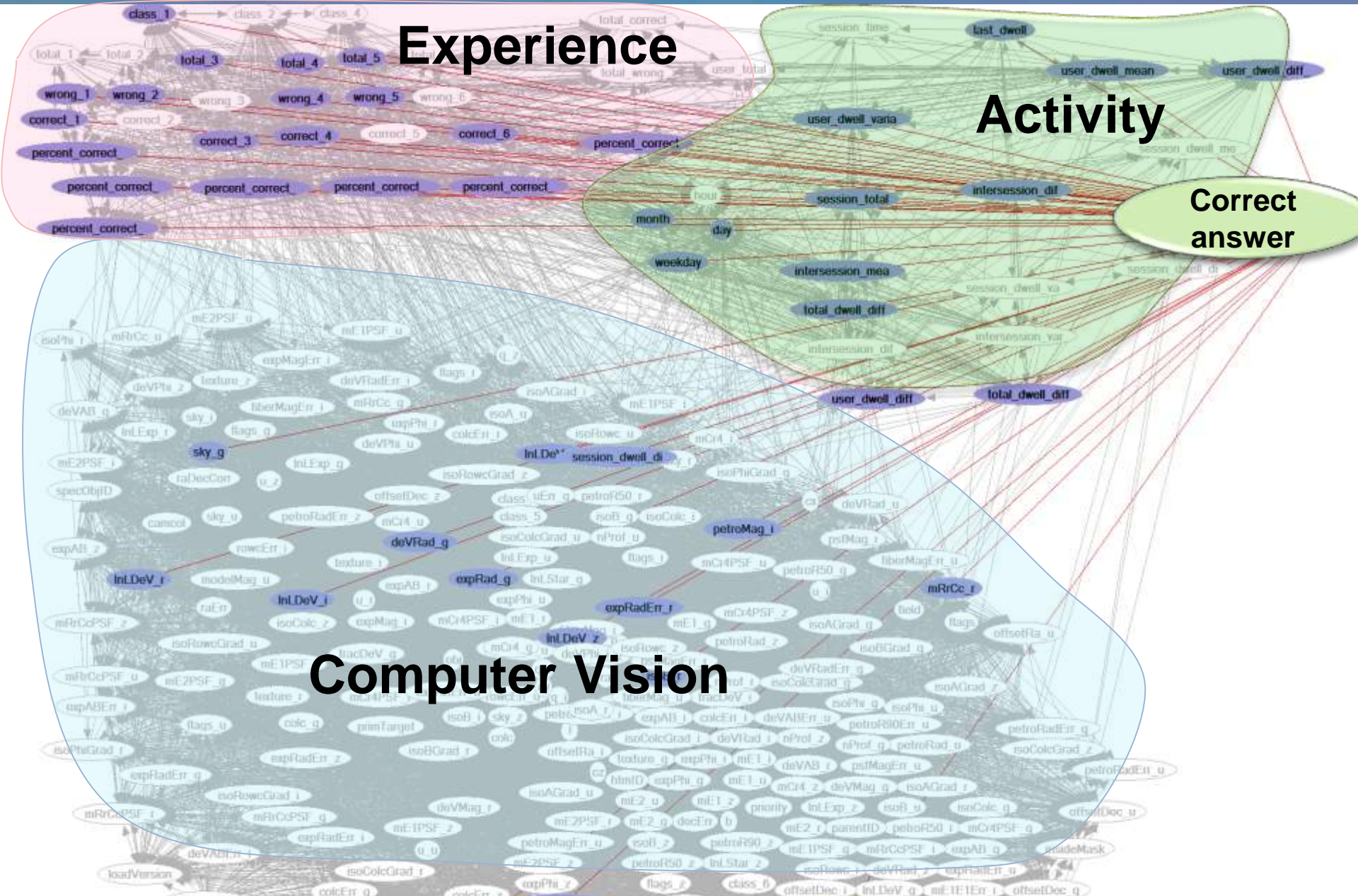
Learn Rich Models of Individuals' Abilities

Experience

Activity

Correct answer

Computer Vision



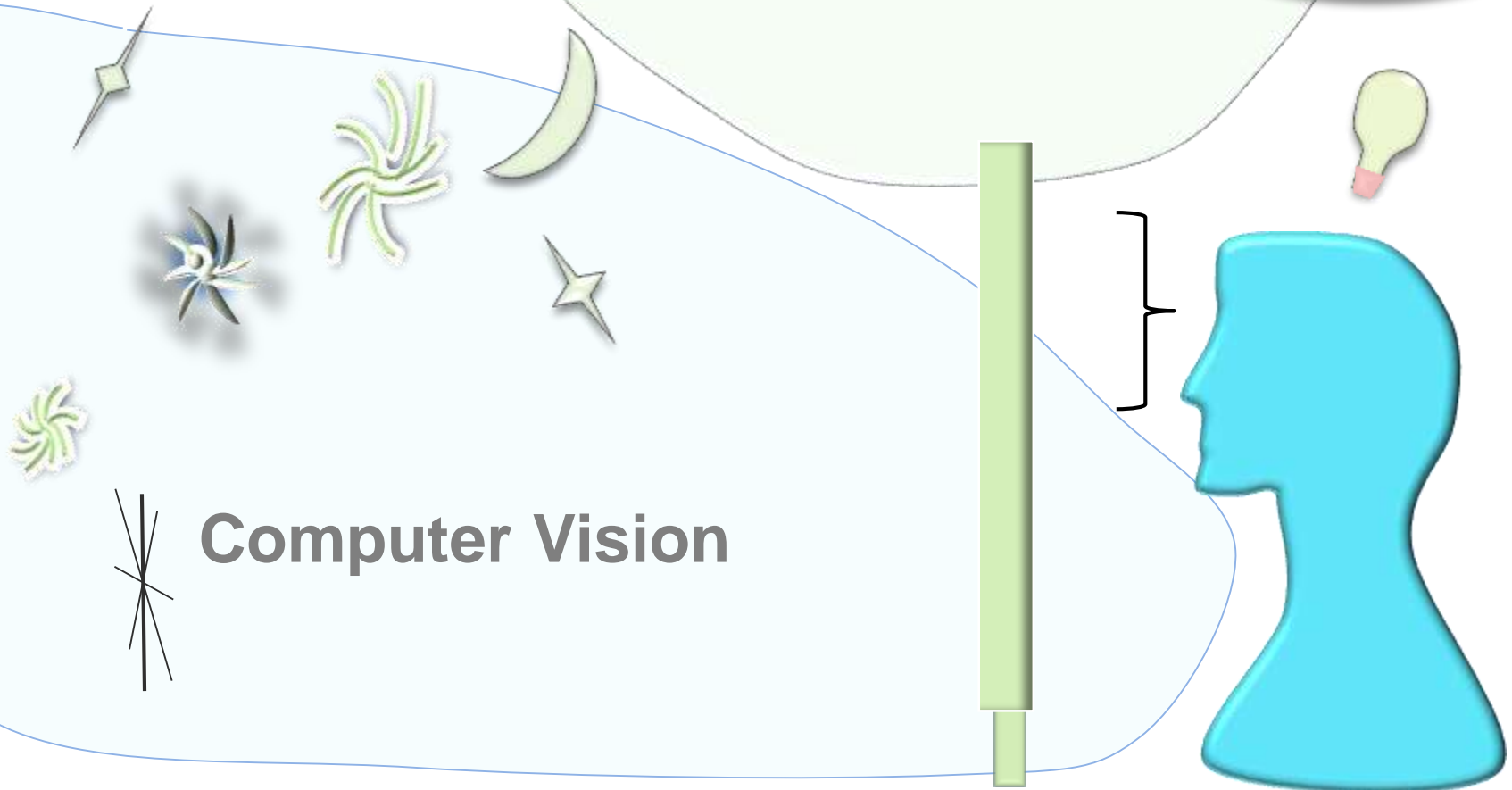
Learn Rich Models of Individuals' Abilities

Experience

Activity

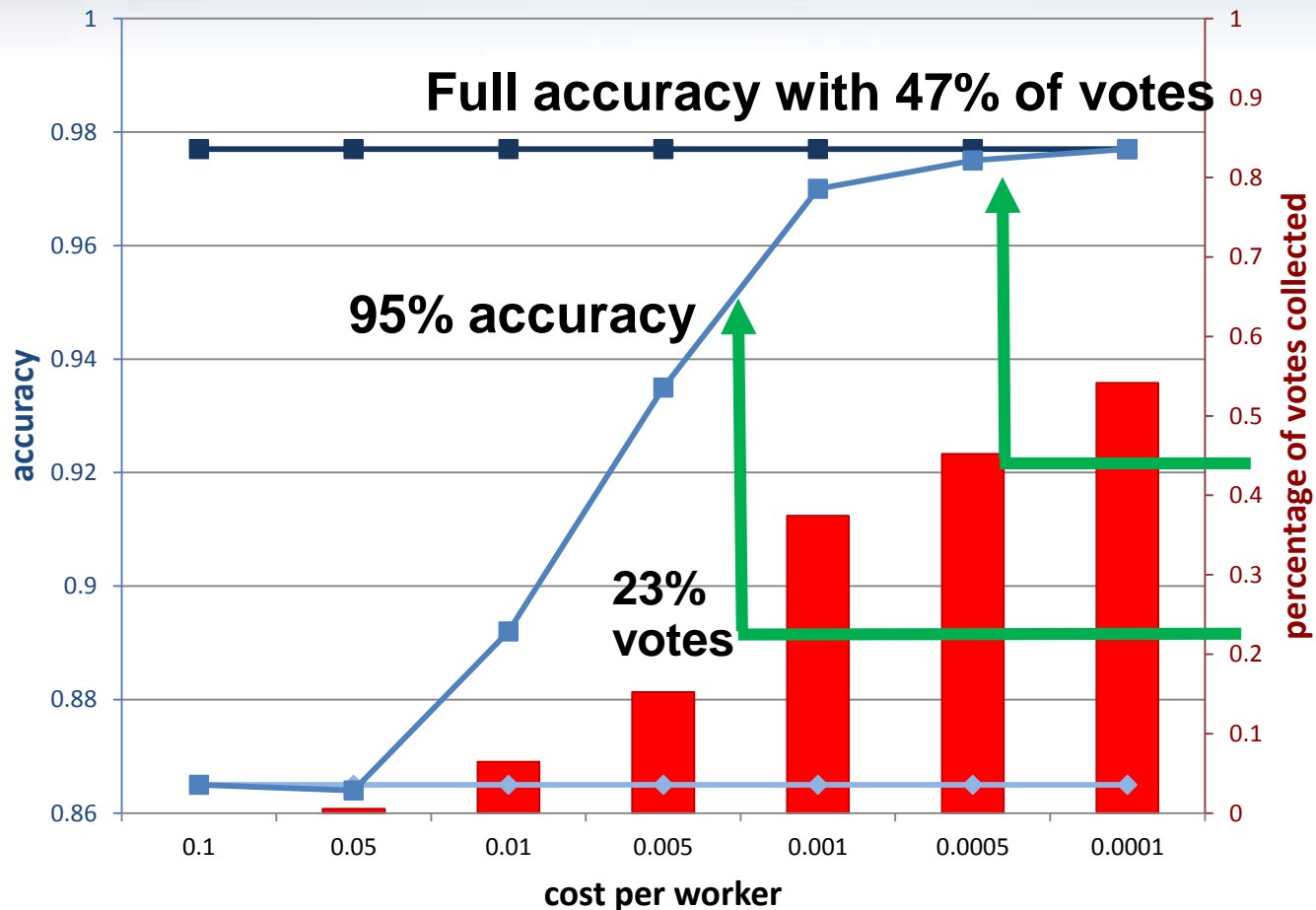
Correct answer

Computer Vision

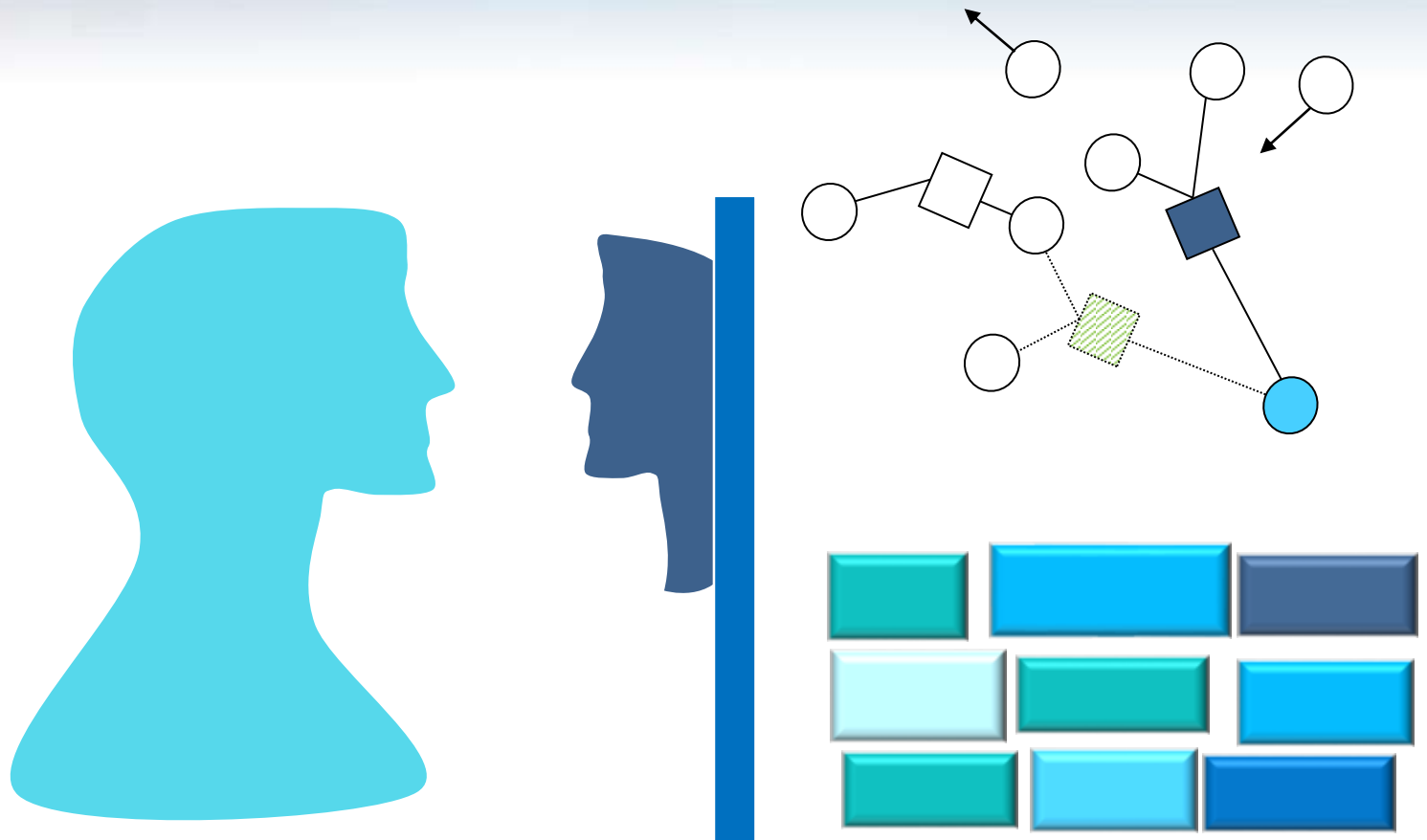


Power of Complementary Computing

- New efficiencies, stopping criteria



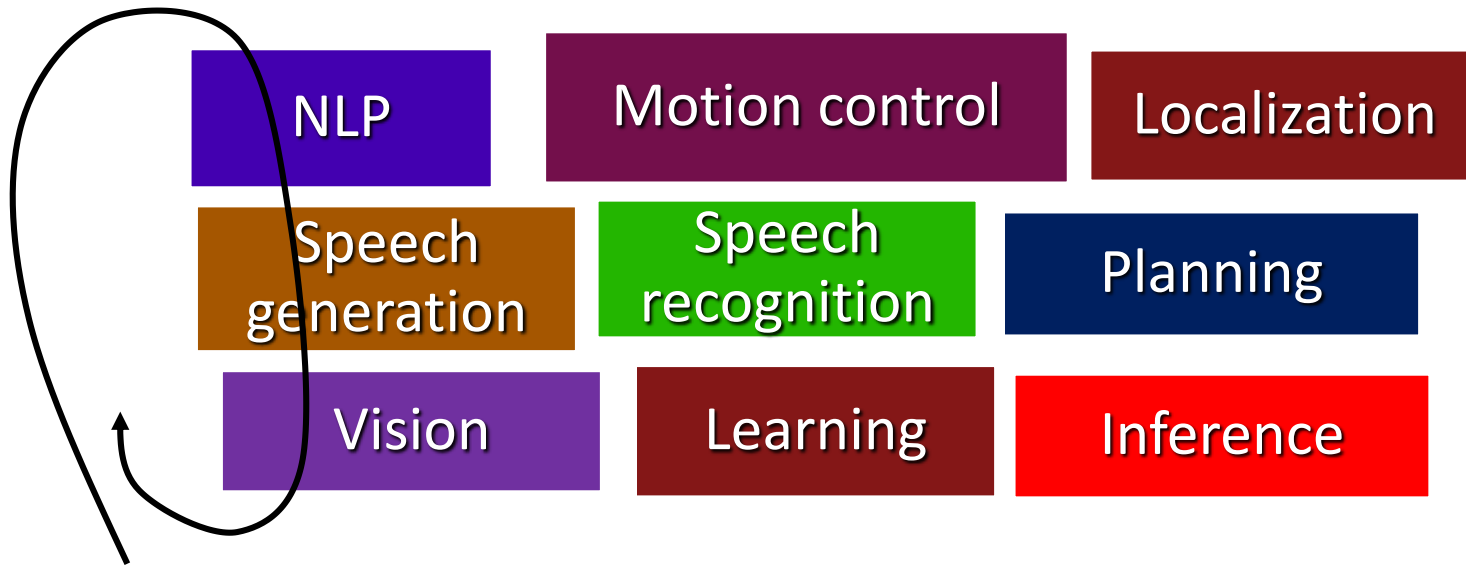
Focus: Integrative Intelligence



With Dan Bohus, Ece Kamar, Paul Koch, Anne Loomis Thompson

Intelligence via Composition

- Leveraging tapestry of components
- Understanding synergies & dependencies
- Whole more than sum?



Whole $\gg \sum_i \text{part } i$?

Situated Interaction



Situated Interaction Project

The image displays a complex software interface for a Situated Interaction Project. It features several windows and panels:

- Top Left:** A wide-angle camera view of a modern building lobby with red seating and large windows. A status bar at the top left reads "SYSTEM STATUS [FPS: 0.00] IsListening".
- Top Center:** A smaller camera view showing a woman smiling, also with the "SYSTEM STATUS [FPS: 0.00] IsListening" status bar.
- Top Right:** A "Select tracks to view" window with a list of elements and floors. The "Current" view is selected, and floor "F: 11" is highlighted.
- Bottom Left:** A camera view from a different angle in the lobby, showing a curved counter and large windows. The status bar reads "SYSTEM STATUS [FPS: 0.00] IsListening".
- Bottom Center:** A control panel with tabs for "Actions", "Interaction Tasks", "Reactive state", and "Display configuration". It includes checkboxes for "Show actors", "Show faces", "Show poses", "Show actions", "Show locations", "Show interactions", "Show virtual objects", "Show system", "Show microphone", and "Show system".
- Bottom Right:** A "Clarence" data analysis window with a menu (File, View, Tracks, Data, Analysis, Help) and a toolbar. It displays "Absolute time" and "Sources" (Events log). The "Annotations" section shows a table of activity durations for various elements:

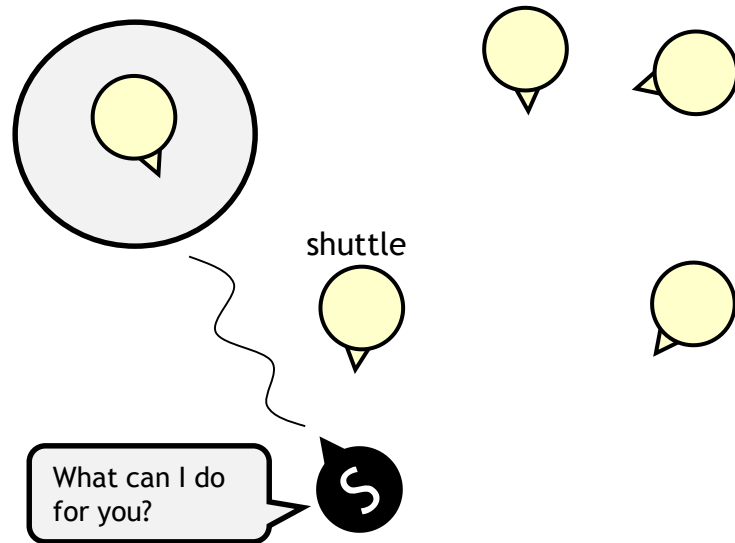
Element	Activity Duration
(FlexPass)	Short duration at the end of the timeline
(LibraryBook)	Short duration in the middle of the timeline
(Shuttle)	Long duration in the middle of the timeline
(Social)	Very short duration in the middle of the timeline
(Shuttle)	Short duration in the middle of the timeline
(CarRegistration)	Short duration towards the end of the timeline
(Mail)	Short duration towards the end of the timeline
(TempBadge)	Short duration towards the end of the timeline
(TempBadge)	Short duration towards the end of the timeline
(PhoneCard)	Short duration towards the end of the timeline
(Shuttle)	Short duration towards the end of the timeline
(Visitor)	Short duration towards the end of the timeline

Models of Multiparty Collaboration

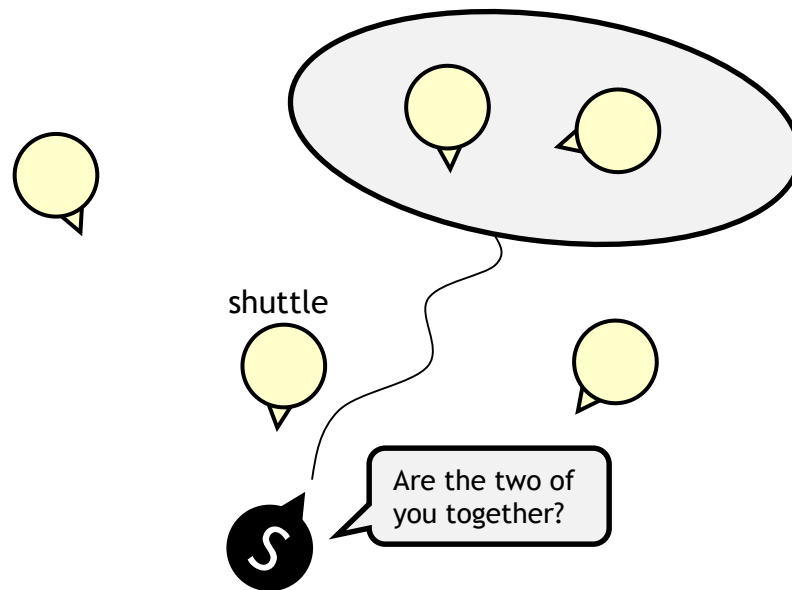
shuttle



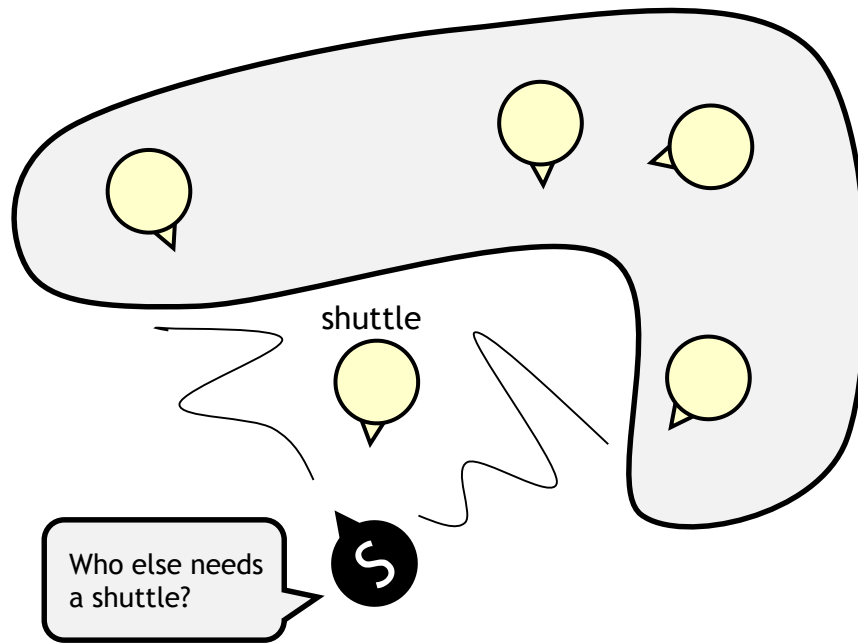
Models of Multiparty Collaboration



Models of Multiparty Collaboration

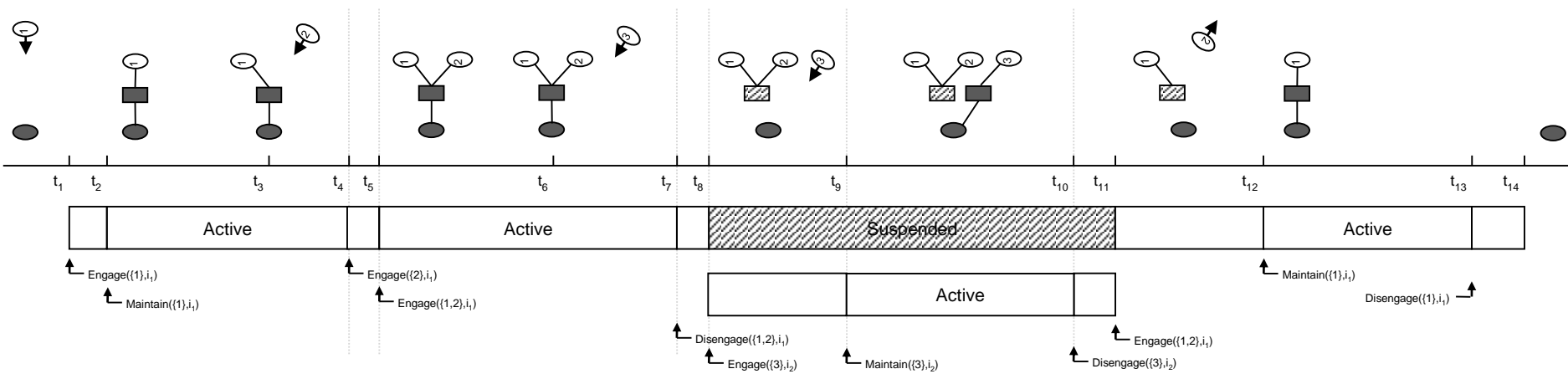
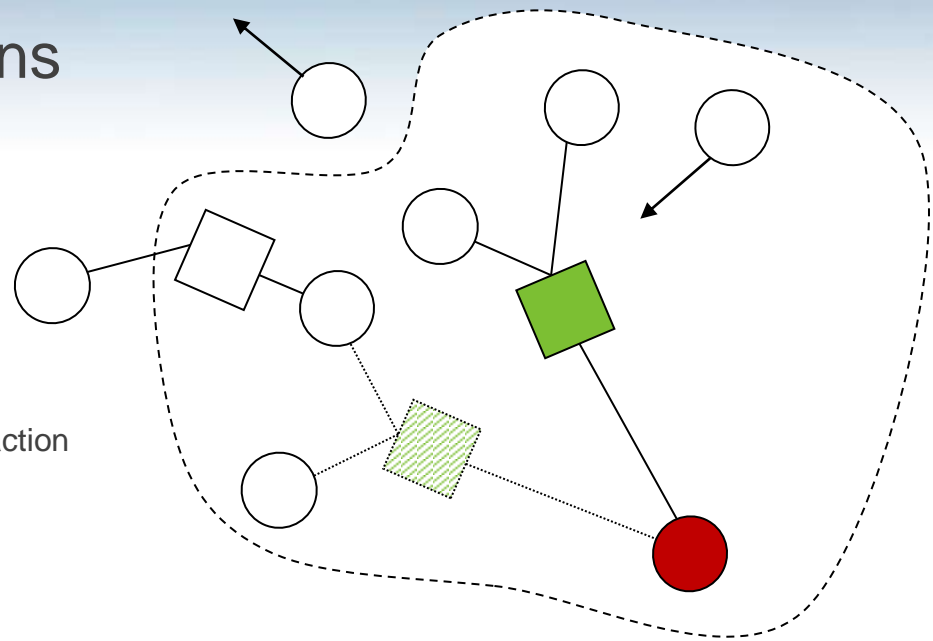
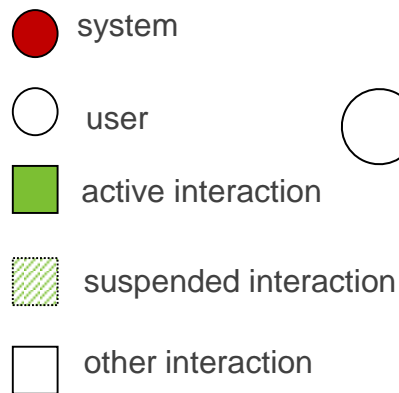


Models of Multiparty Collaboration

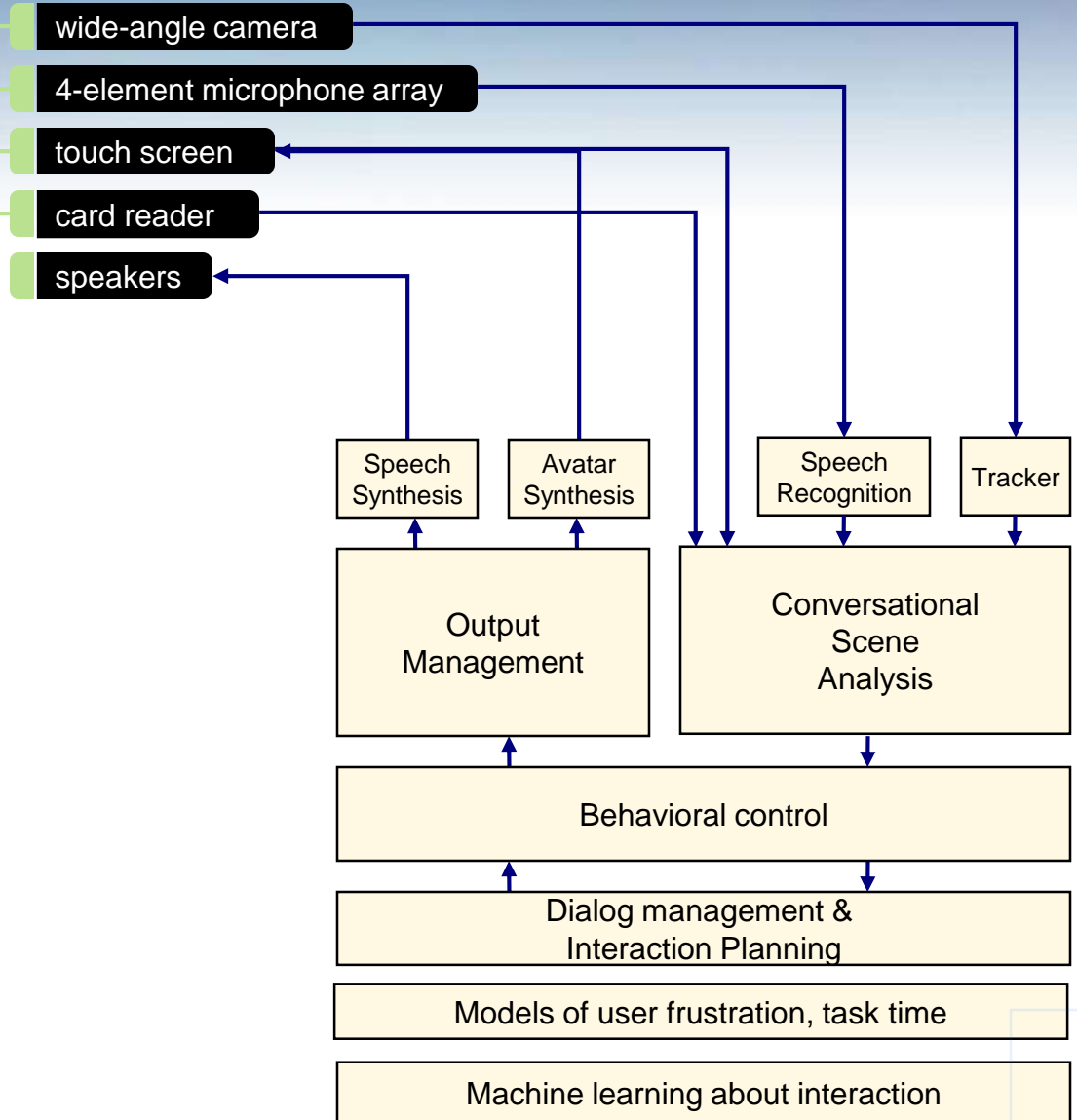


Contributions & Turns in the Open World

Track conversational dynamics
Make turn-taking decisions



Composing a Platform



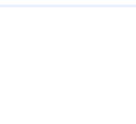
Multiple Tasks and Participants

The image is a composite of three main visual elements:

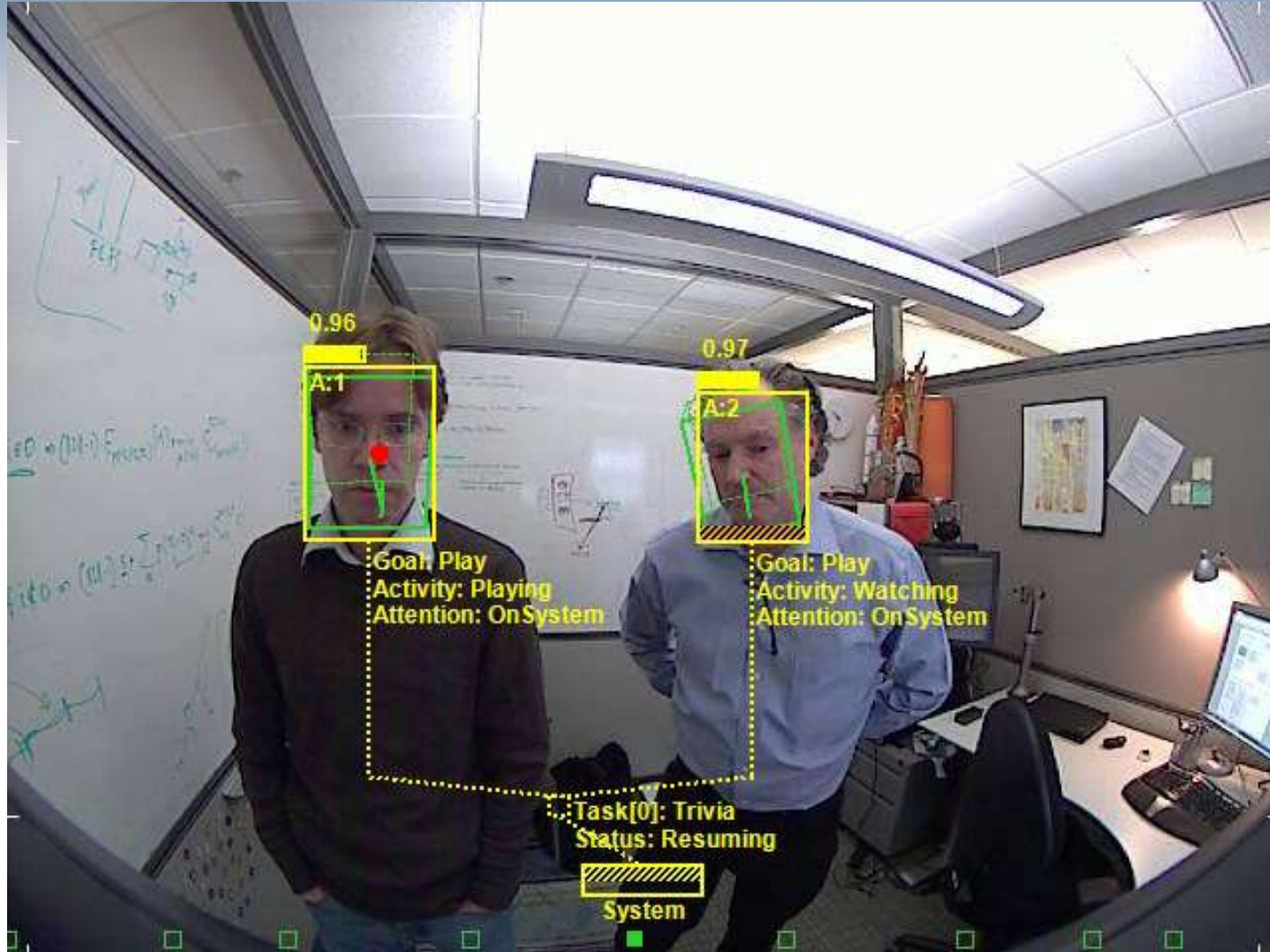
- System Performance (Top Left):** Displays four graphs: CPU Usage (32%), CPU Usage History, Memory (1.56 GB), and Physical Memory Usage History.
- Participant Video (Middle Left):** Shows a close-up of a woman's face. Above her is a 'shuttle reservation' interface with two progress bars.
- Interaction Visualization (Right):** A large window titled 'Visualization' showing a 360-degree view of a room with two men. The 'SYSTEM STATUS [FPS: 3.92]' is listed as 'IsListening', 'AllowsBargain', and 'InConversation'. Behavioral data is overlaid on the men:
 - Man 1 (Left):** A-14, 0.90. Attributes: Wear[Casual], Affiliation[None], Engaged[0.77], Attention[OnOther], HasFloor, WasSpeaking[and ToOther].
 - Man 2 (Right):** A-15, 0.85. Attributes: Wear[Casual], Affiliation[MS], Engaged[0.80], Attention[OnOther], HasFloor, This [Active], Goal[Shuttle].
 - Man 3 (Far Right):** A-16, 0.85. Attributes: Wear[Small], Affiliation[None], NotEngaged[0.04], Attention[OnSystem], T:16 [Pending], Goal[Register].

At the bottom of the visualization window, there is a row of seven green circular icons labeled 0 through 7.

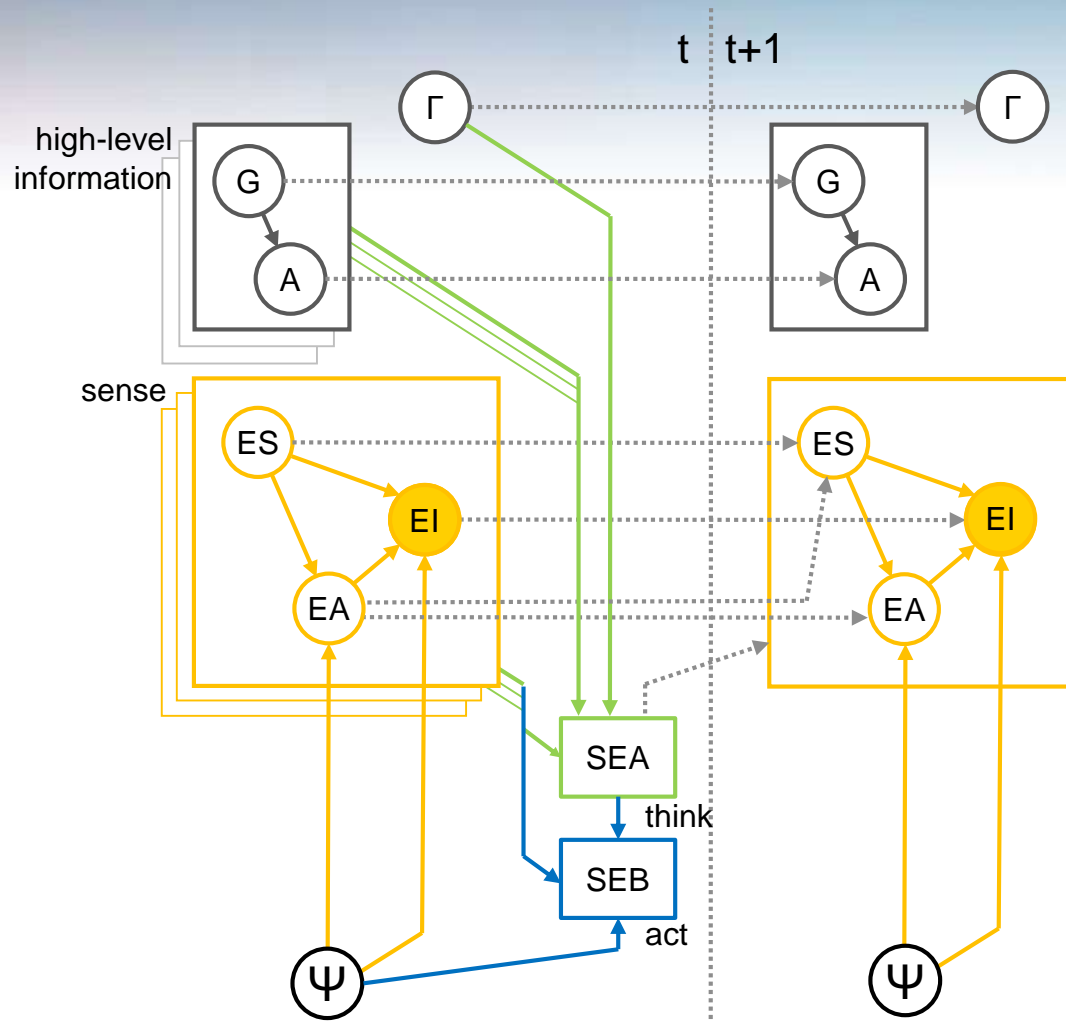
Multiple Tasks and Participants



Multiparty Collaboration & Turn Taking



Representation and Inference



Ψ = all sensory evidence

ES = engagement state
{ engaged, not-engaged }

EA = engagement action
{ maintain, disengage, engage, no-action }

EI = engagement intention
{ engaged, not-engaged }

SEA = system engagement action
{ maintain, disengage, engage, no-action }

SEA = $\pi(ES, EA, EI, G, A, \Gamma)$

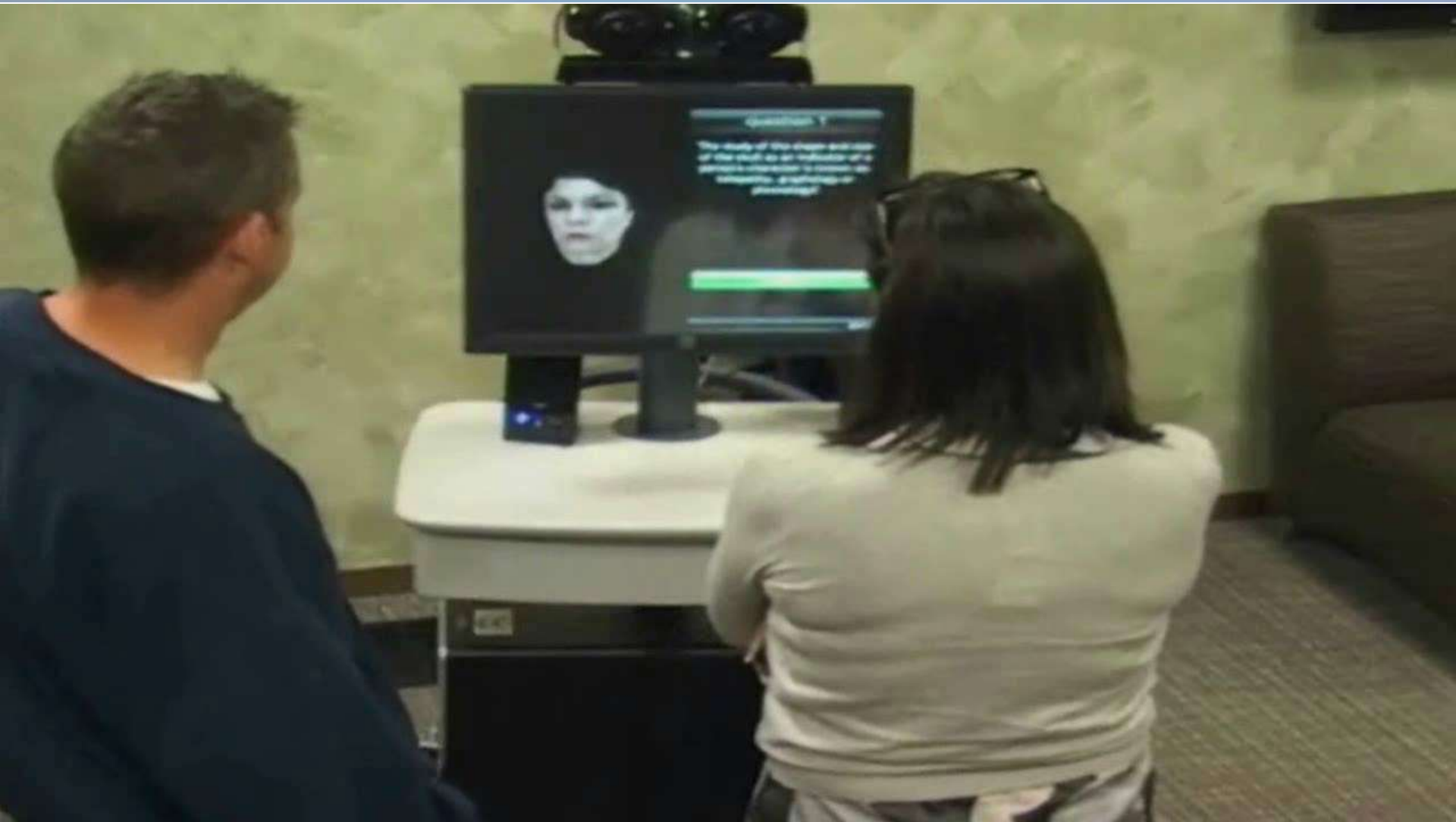
G = high-level goal
{ shuttle, register, other }

A = high-level activity
{ interacting, waiting-for-receptionist, waiting-for-other, passing-by }


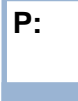



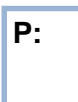
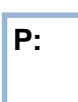

Γ = grouping information

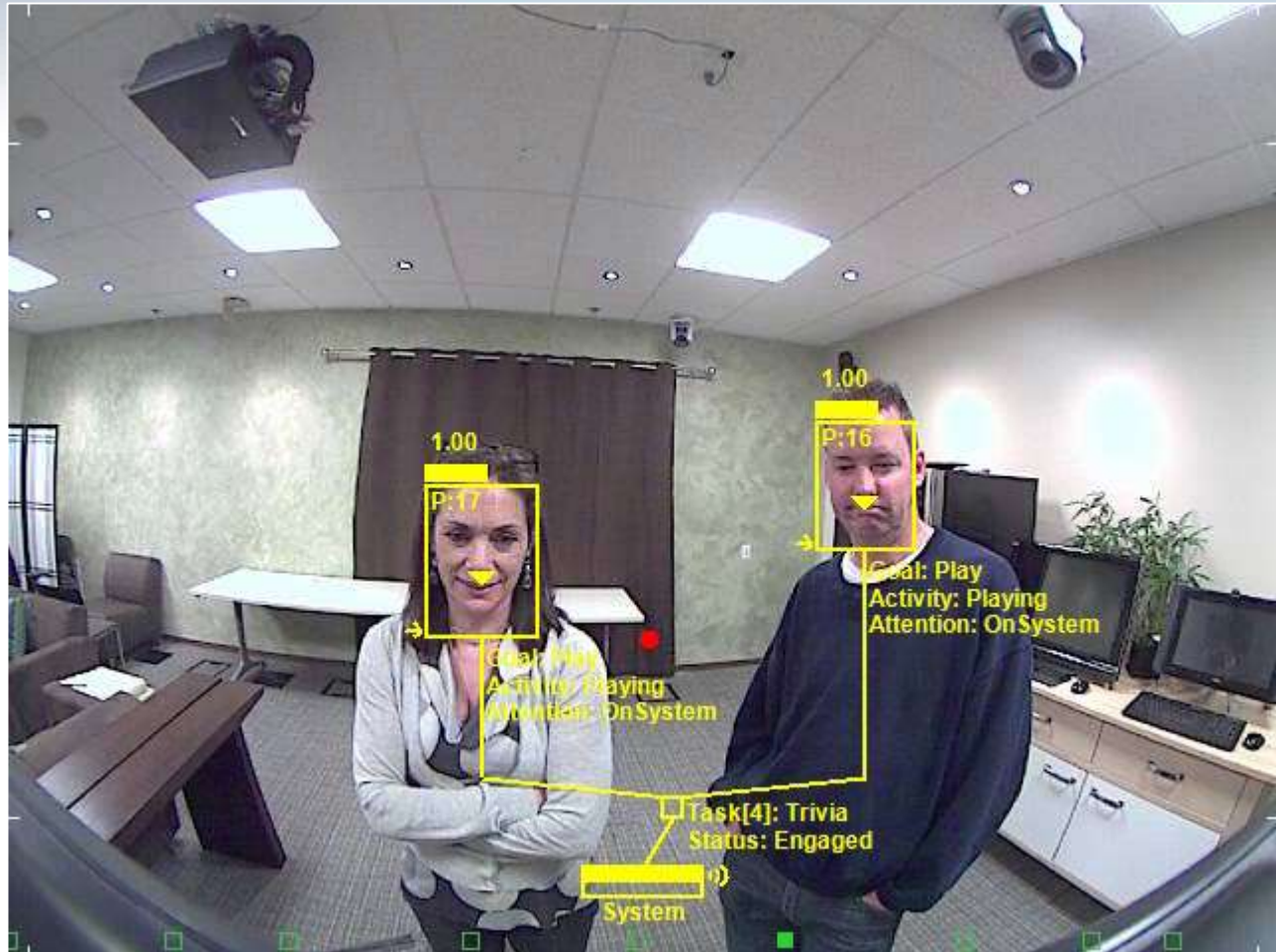
SEB = system engagement behavior
{ glance, greet, excuse-me, etc. }

Experiments



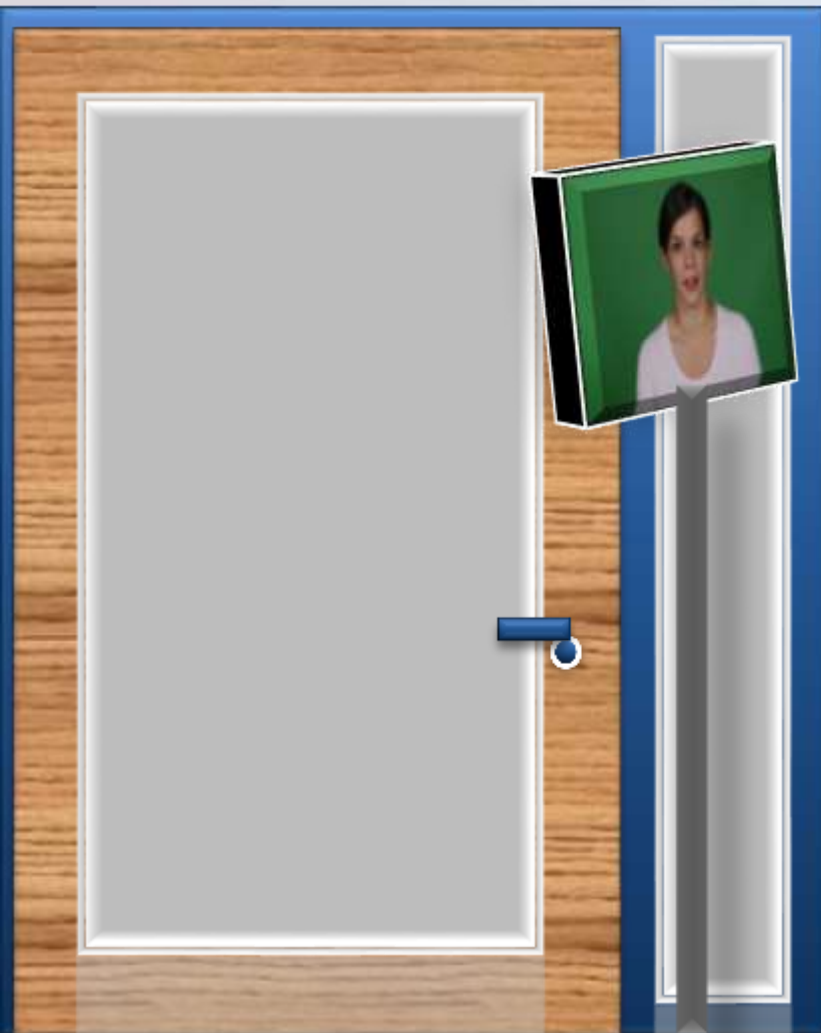
Experiments

- P:**  arrow indicates direction of attention
- P:**  P has floor
- P:**  P is the target of the floor release
- P:**  P is releasing the floor
- P:**  P is trying to take the floor (performs TAKE action)
- P:**  P is speaking
- P:**  P is an addressee
-  indicates system's gaze direction



Personal Assistant

Perception, learning, reasoning components



Multiparty Engagement & Dialog



Prediction about *presence*

Prediction of *cost of interruption*

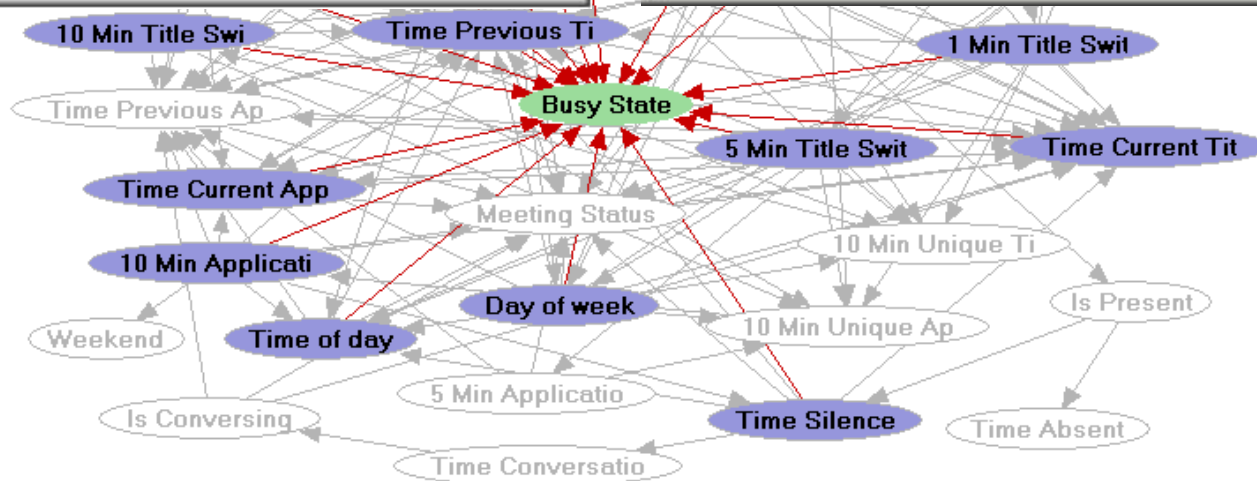
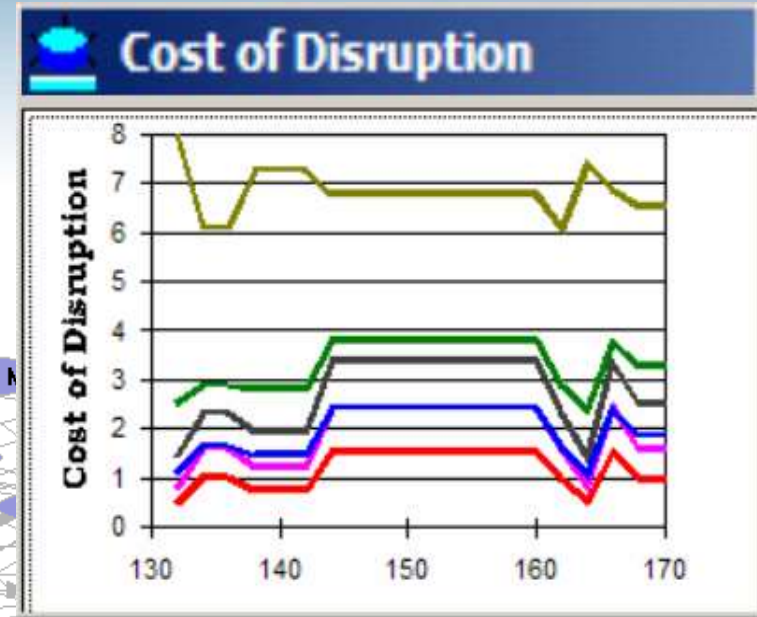
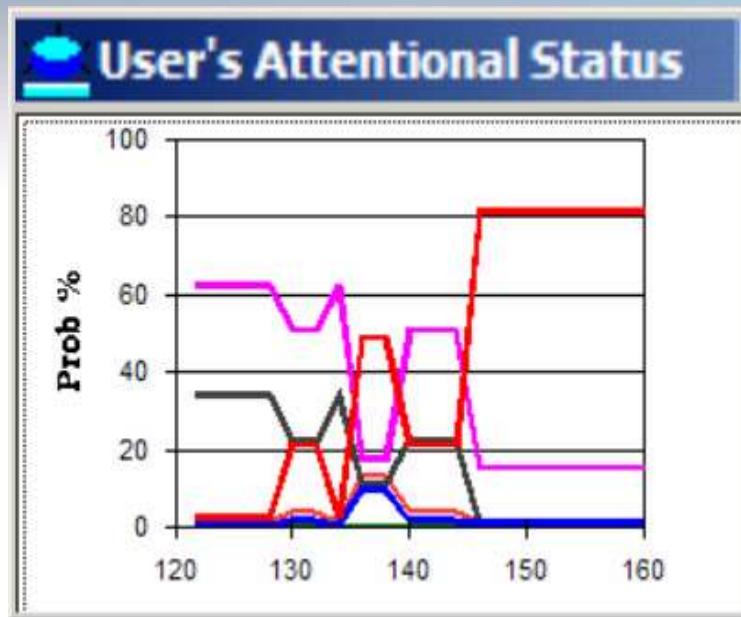
Prediction about *forgetting*

Prediction of *message urgency*

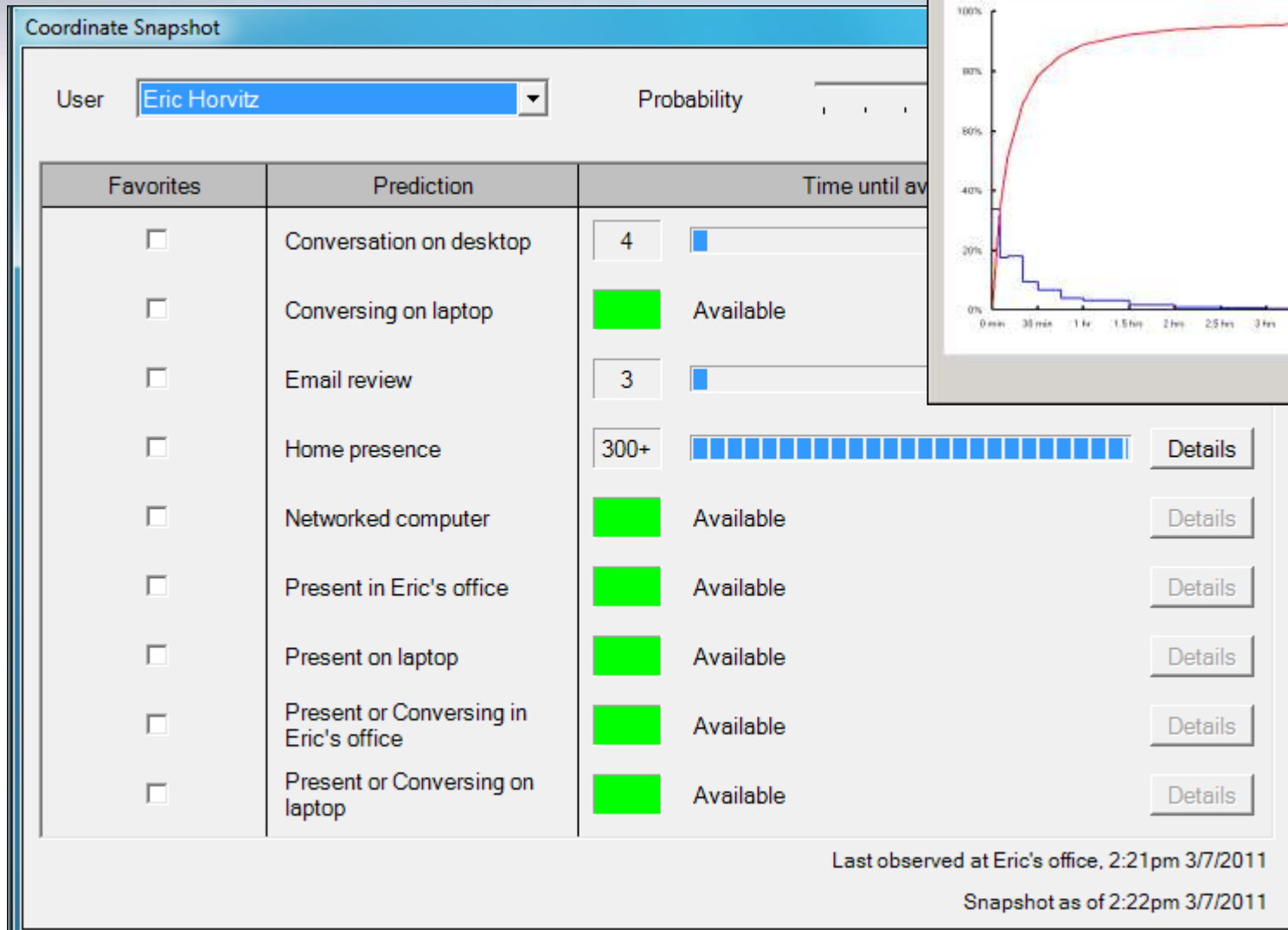
Personal Assistant



Learned Models: Cost of Interruption



Learned Models of Presence



Personal Assistant

Personal Assistant

Microsoft Research

Personal Assistant

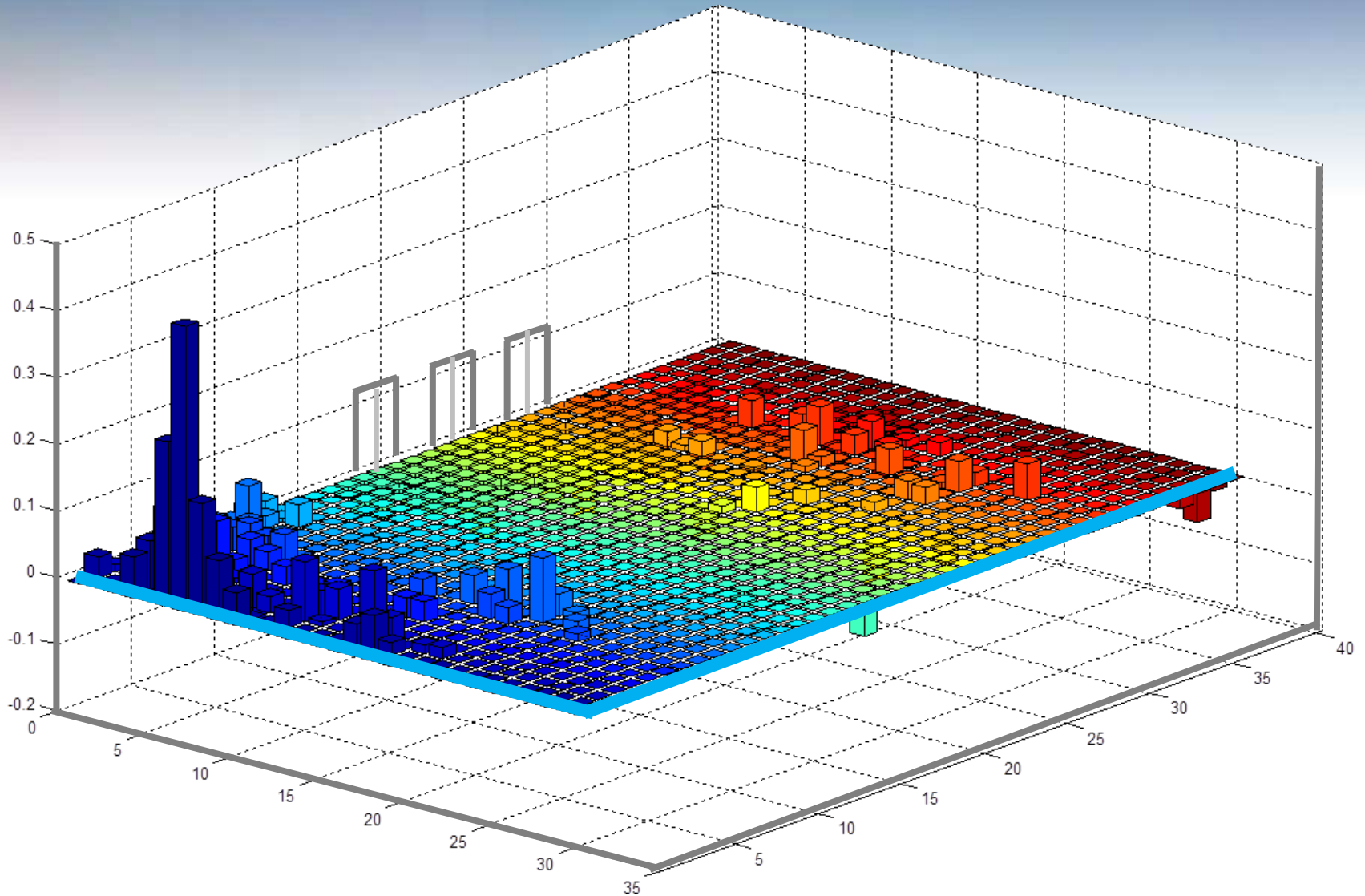


Broader Applications of Platform

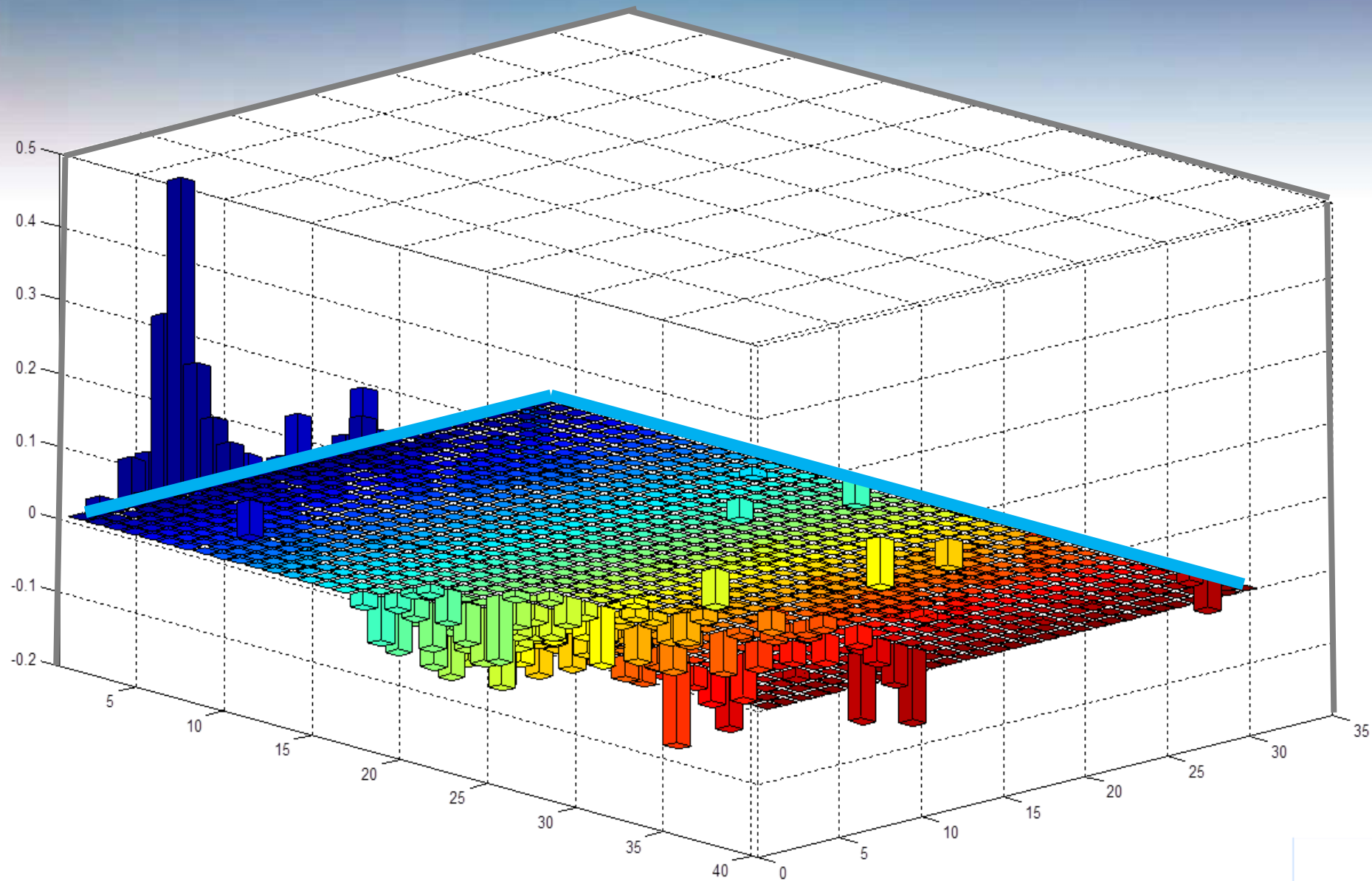


Project 3E

Identifying Critical Regions

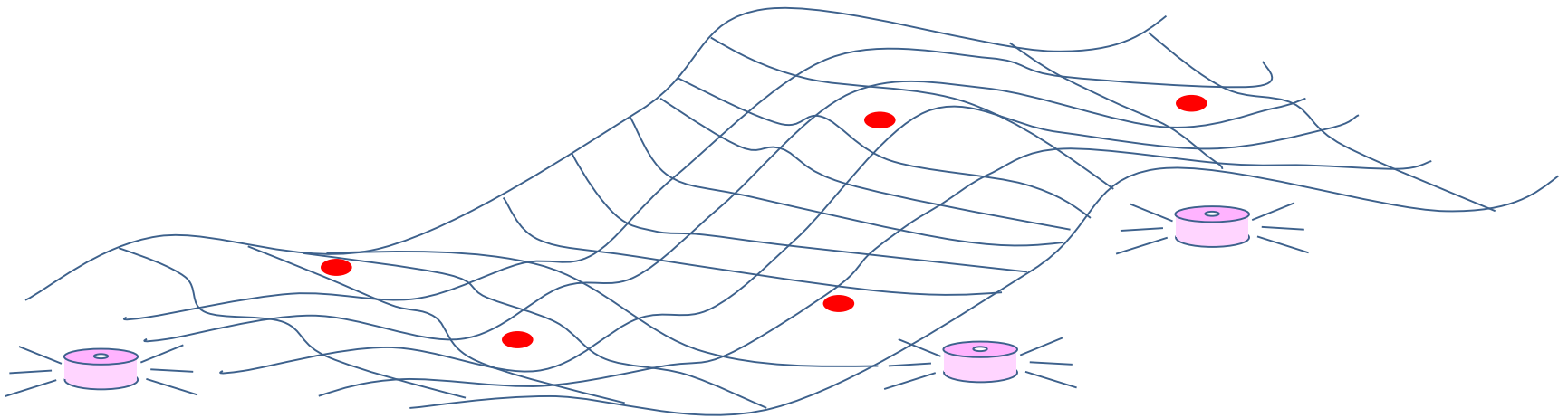


Identifying Critical Regions



Summary

- Applications of sensing, learning, and reasoning still in infancy
- Unprecedented value to people and society
- Principles → Applications → Principles ...



Microsoft
Research



Microsoft Research Asia
Faculty Summit 2012

Privacy, Data, and Machine Learning

Urgency ...and optimism

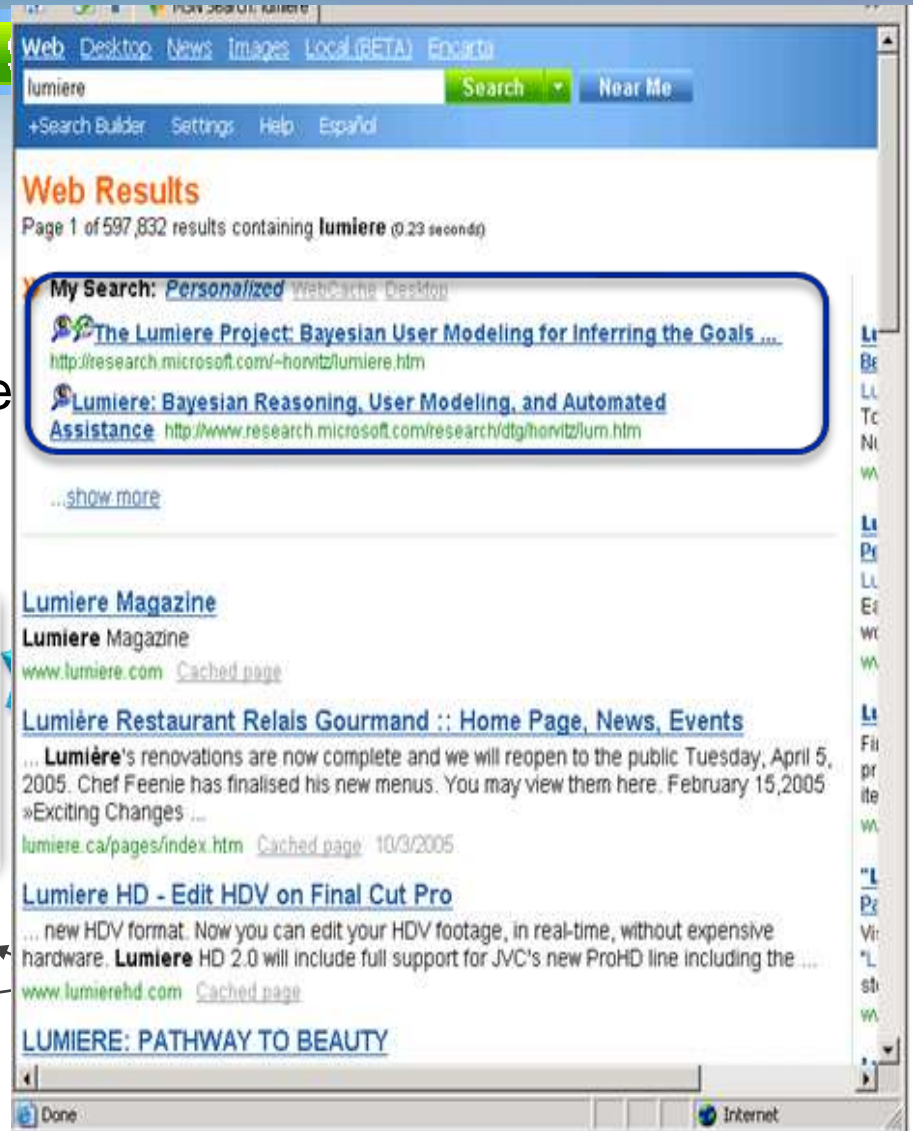
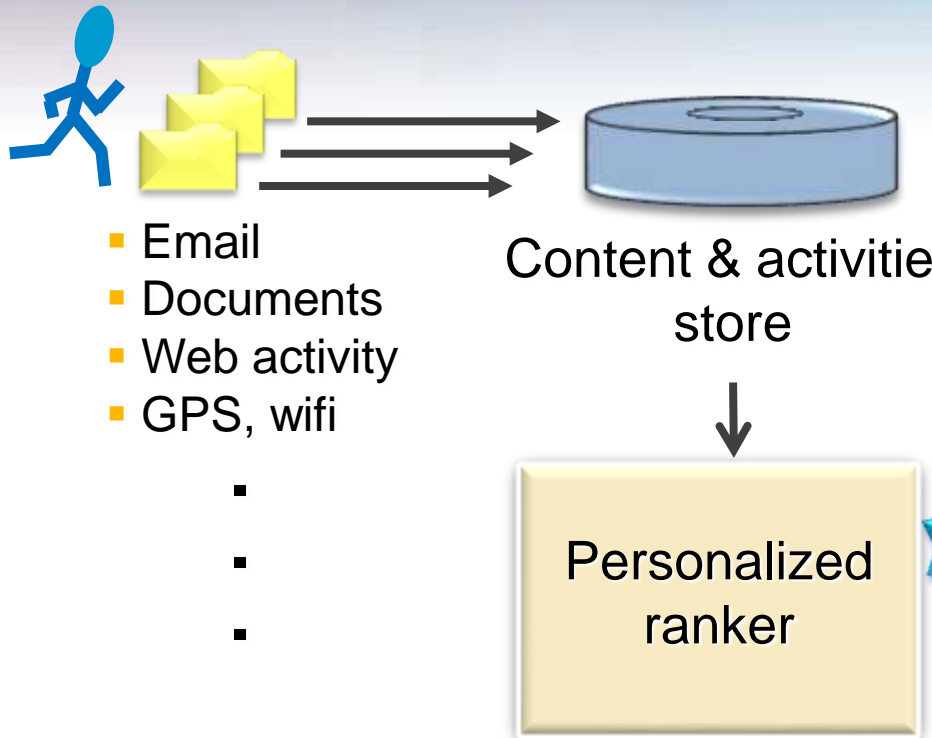
Clarity, preferences, and handles

Decision-theoretic mediation

Differential privacy

Protected sensing & personalization

Example: Personalized Search (Psearch)



Results from web search engine

Example: Lifebrowser

Images
& videos

Desktop
& search activity

Appts &
events

Locations

Whiteboard
capture

Query

MemoryLens - Landmark Trainer


Date	Subject	Landmark
Nov 17, 2010	MSR Redmond Managers Meeting	<input type="radio"/> Yes <input type="radio"/> No
Nov 17, 2010	pnewson 1:1	<input type="radio"/> Yes <input type="radio"/> No
Nov 17, 2010	Fun Snack Break	<input type="radio"/> Yes <input type="radio"/> No
Nov 17, 2010	Edith Law	<input type="radio"/> Yes <input type="radio"/> No
Nov 17, 2010	MSR Talk Series: Inclusive Design; Wendy Chisholm - M	<input type="radio"/> Yes <input type="radio"/> No
Nov 17, 2010	MSR Talk Series: Cross-Compiling Android Applications t	<input type="radio"/> Yes <input type="radio"/> No
Nov 17, 2010	Canceled: RRLT Meeting	<input type="radio"/> Yes <input type="radio"/> No
Nov 17, 2010	jenn	<input type="radio"/> Yes <input type="radio"/> No
Nov 16, 2010	Dinner with Mike Gillam, et al.	<input type="radio"/> Yes <input type="radio"/> No
Nov 16, 2010	MSR Visiting Speakers Series: The Amazing Story of Qu	<input type="radio"/> Yes <input type="radio"/> No
Nov 16, 2010	Placeholder for rollerblading (only if time and the weather	<input type="radio"/> Yes <input type="radio"/> No
Nov 16, 2010	Stephanie Rosenthal PhD Oral Exam	<input checked="" type="radio"/> Yes <input type="radio"/> No
Nov 16, 2010	Ece and Eric meeting	<input type="radio"/> Yes <input type="radio"/> No
Nov 16, 2010	MSR Talk Series: Girls, Programming and Processing: E	<input type="radio"/> Yes <input type="radio"/> No
Nov 16, 2010	Sue/Eric catchup	<input type="radio"/> Yes <input type="radio"/> No

Most memorable


Date

Feb 4 2005

Fri




Thu



NRAC Italy Meeting

Wed

Tue



Farewell Party

Mon

MSMLS coo

