Intelligent Systems (AI-2)

Computer Science cpsc422, Lecture 34

Nov, 29, 2019

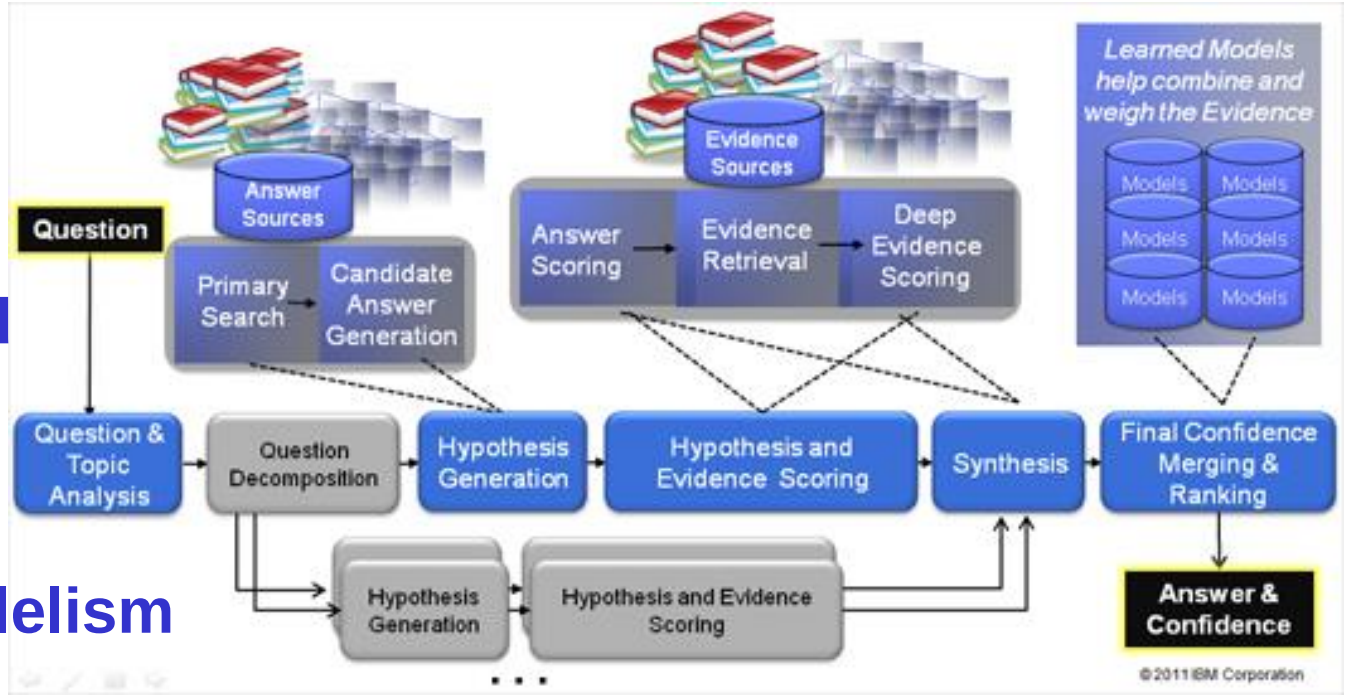
JEOPARDY! The IBM Challenge

Watson : analyzes natural language questions and content well enough and fast enough to compete and win against champion players at Jeopardy!

Clue: *"This Drug has been shown to relieve the symptoms of ADD with relatively few side effects."*

Answer: *"What is Retail ?"*

- **1000s of algorithms and KBs**
- **3 secs**
- **Massive parallelism**



Source: *IBM*

AI techniques in 422 / Watson

- Parsing (PCFGs)
- Shallow parsing (NP segmentation with CRFs)
- Entity and relation Detection (NER with CRFs)
- Logical Form Generation and Matching
- Logical Temporal and Spatial Reasoning
- Leveraging many databases, taxonomies, and ontologies (help only 25% of questions)
- Confidence… Probabilities (Bnets to rank)
- Strategy for playing *Jeopardy*…statistical models of players and games, game-theoretic analyses … … and application of reinforcement-learning (Buzz-in-Bets)

From silly project to $1 billion investment

2005-6 "IT'S a silly project to work on, it's too gimmicky, it's not a real computer-science test, and we probably can't do it anyway." These were reportedly the first reactions of the team of IBM researchers challenged to build a computer system capable of winning "Jeopardy!

……after 8-9 years…

On January 9th 2014, with much fanfare, the computing giant announced plans to invest $1 billion in a new division, IBM Watson Group. By the end of the year, the division expects to have a staff of 2,000 plus an army of external app developers …..Mike Rhodin, who will run the new division, calls it "one of the most significant innovations in the history of our company." Ginni Rometty, IBM's boss since early 2012, has reportedly predicted that it will be a $10 billion a year business within a decade.

IBM Watson

More complex questions in the future....

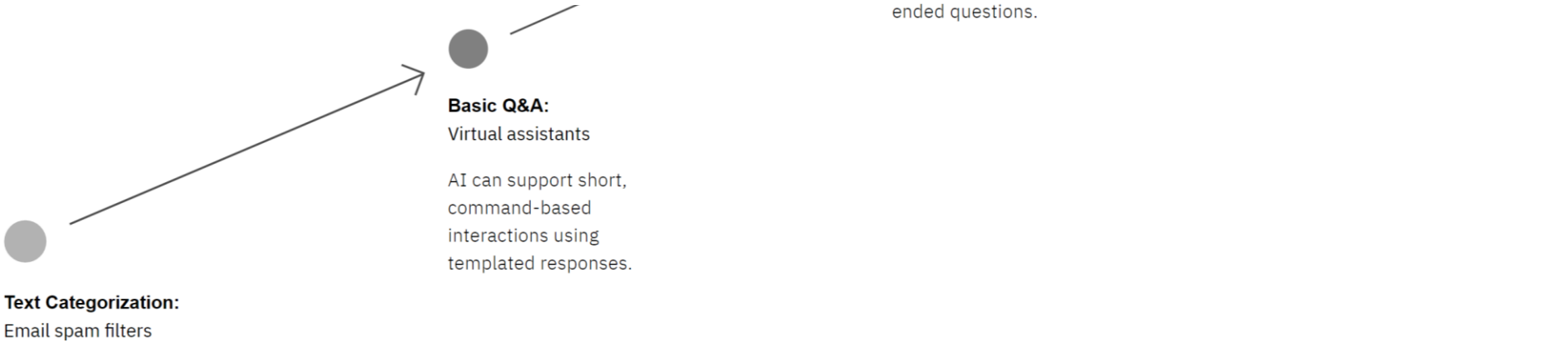
Or something like: “Should Europe reduce its energy dependency from Russia and what would it take?”

And interactive, collaborative question-answering / problem solving

Why is Project Debater important?

The rise of one-sided and doctored narratives is challenging society and our platforms. Too often, we talk past one another. We need a smarter way. New developments in language and reasoning in AI can help shine a light in the darkness of distorted facts to provide diverse, well-informed viewpoints—both the pro and the con.

The world is awash with information, misinformation, and superficial thinking. Project Debater pushes the frontiers of AI to facilitate intelligent debate so we can build well-informed arguments and make better decisions.



AI applications.....

- DeepQA
- Personal Assistants
- Robotics
- Search Engines
- Games
- Tutoring Systems
- Medicine / Finance / …
- ……

Most companies are investing in AI and/or developing/adopting AI technologies

Lecture Overview

- TA Evaluations / Teaching Evaluations
- IBM Watson...
- **After 422...**
- **(422) Highlights from conferences**
- **Final Exam: how to prepare…**

422 big picture

StarAI (statistical relational AI)

Hybrid: Det +Sto

Prob CFG

Prob Relational Models

Markov Logics

	Deterministic	Stochastic
Query	***Logics***	***Belief Nets***
	Full Propositional	**Approx. : Gibbs**
	First Order Logics	***Markov Chains and HMMs***
	Ontologies –	**Forward, Viterbi….**
	Knowledge Graphs	**Approx. : Particle Filtering**
	• **Full Resolution**	***Markov Networks***
	• **SAT**	***Conditional Random Fields***
	• **Concept Similarity**	
Planning		***Markov Decision Processes and Partially Observable MDP***
		• **Value Iteration**
		• **Approx. Inference**
		Reinforcement Learning
		Q-learning, SARSA

Representation

Reasoning Technique

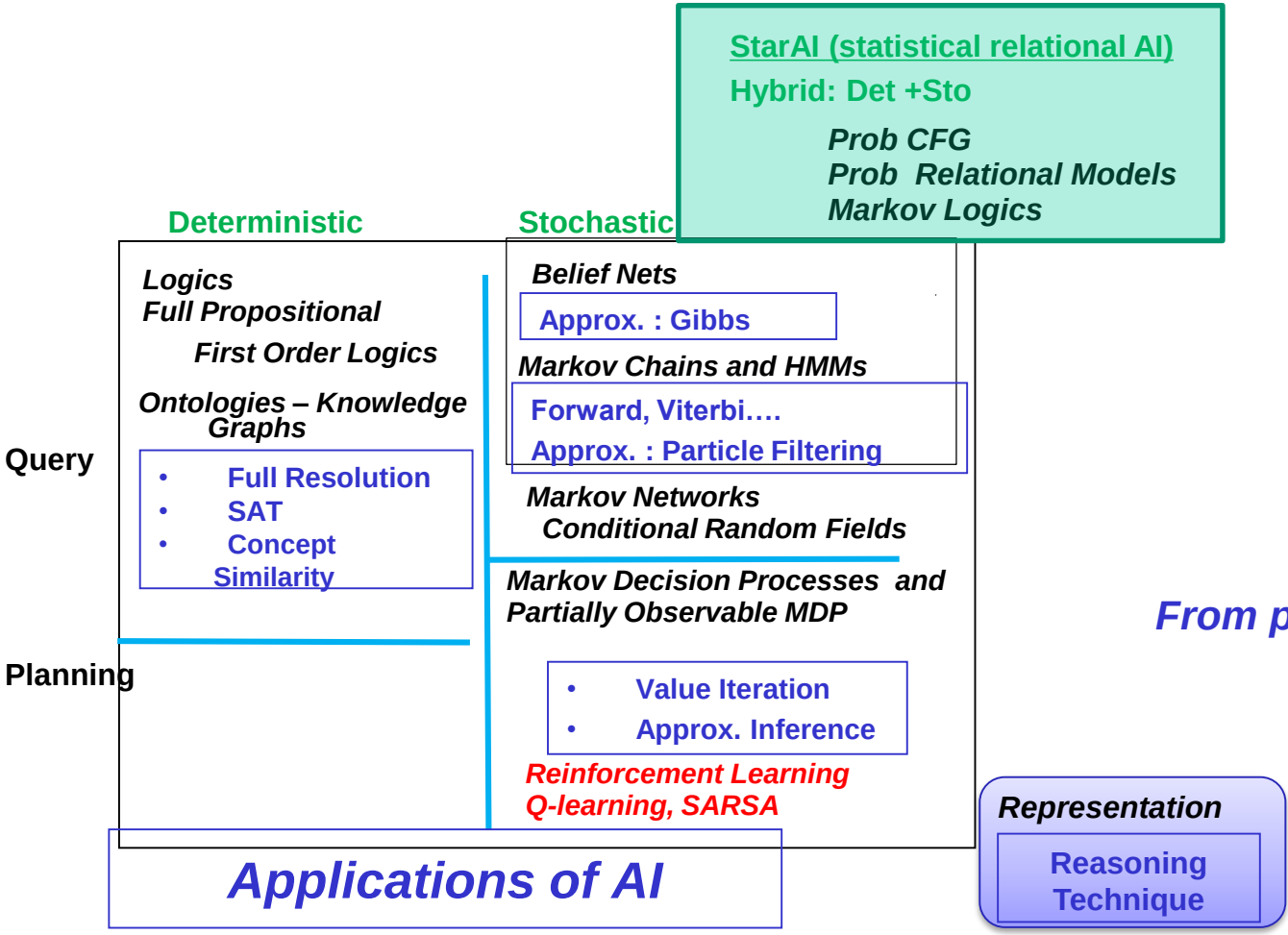
Applications of AI

After 422…..

Machine Learning + Neural Models

Knowledge Acquisition

Preference Elicitation



Where are the components of our representations coming from?

The probabilities?

The utilities?

The logical formulas?

From people and from data!

Some of our Grad Courses

522: Artificial Intelligence II : Reasoning and Acting Under Uncertainty

Sample Advanced Topics…..

Relational Reinforcement Learning for Agents in Worlds with Objects, relational learning.

- Probabilistic Relational Learning and Inductive Logic Programming at a Global Scale,

Some of our Grad Courses

503: Computational Linguistics I / Natural Language Processing

Sample Advanced Topics…..

- Topic Modeling (LDA) – Large Scale Graphical Models – Gibbs Sampling
- Discourse Parsing by Distant Supervision (CKY + Neural Nets)
- Abstractive Summarization (Neural Nets + Concept similarity)

Other AI Grad Courses: check them out

532: Topics in Artificial Intelligence (different courses)

- User-Adaptive Systems and Intelligent Learning Environments
- Foundations of Multiagent Systems
- Multimodal Learning with Vision, Language and Sound

540: Machine Learning

505: Image Understanding I: Image Analysis

525: Image Understanding II: Scene Analysis

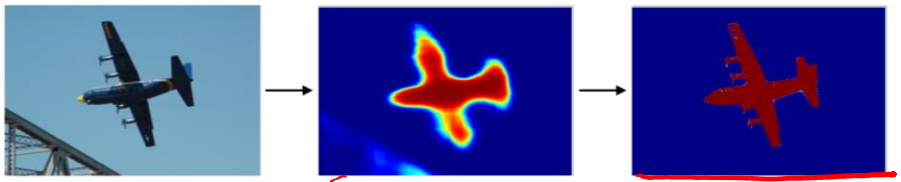
515: Computational Robotics

Connection with Neural Models / Deep-Learning

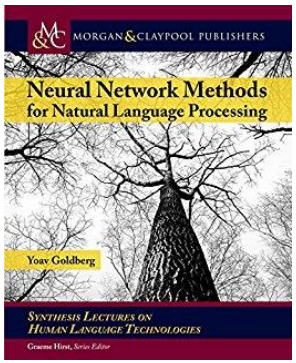
NN + Reinforcement Learning: e.g. Alpha-Go (Deep Mind)

http://karpathy.github.io/2016/05/31/rl/

NN (rough prediction) + CRF (refine prediction): Vision (Google paper)

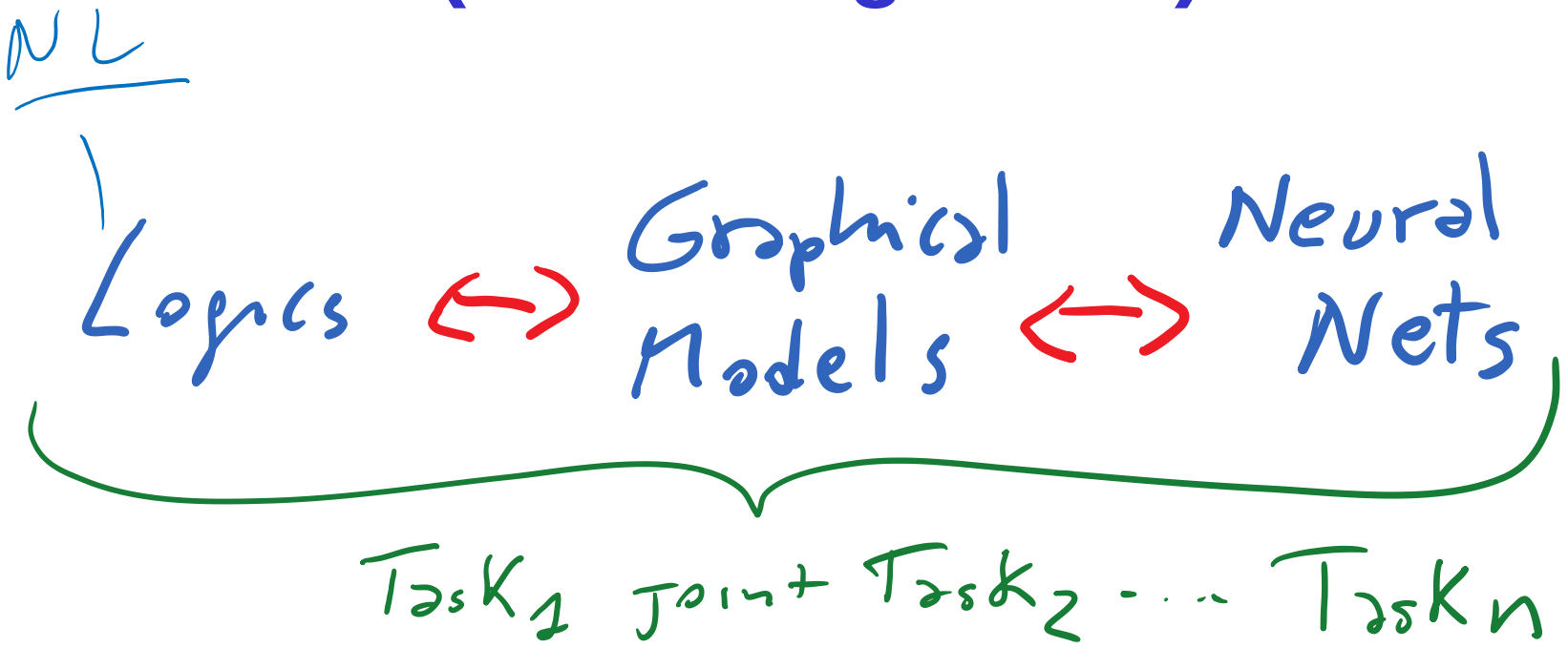


NN + CRF + CKY for NLP (Goldberg book. 2017, Pag 224)



AI Representation & Reasoning & Learning future in a nutshell (according to me)

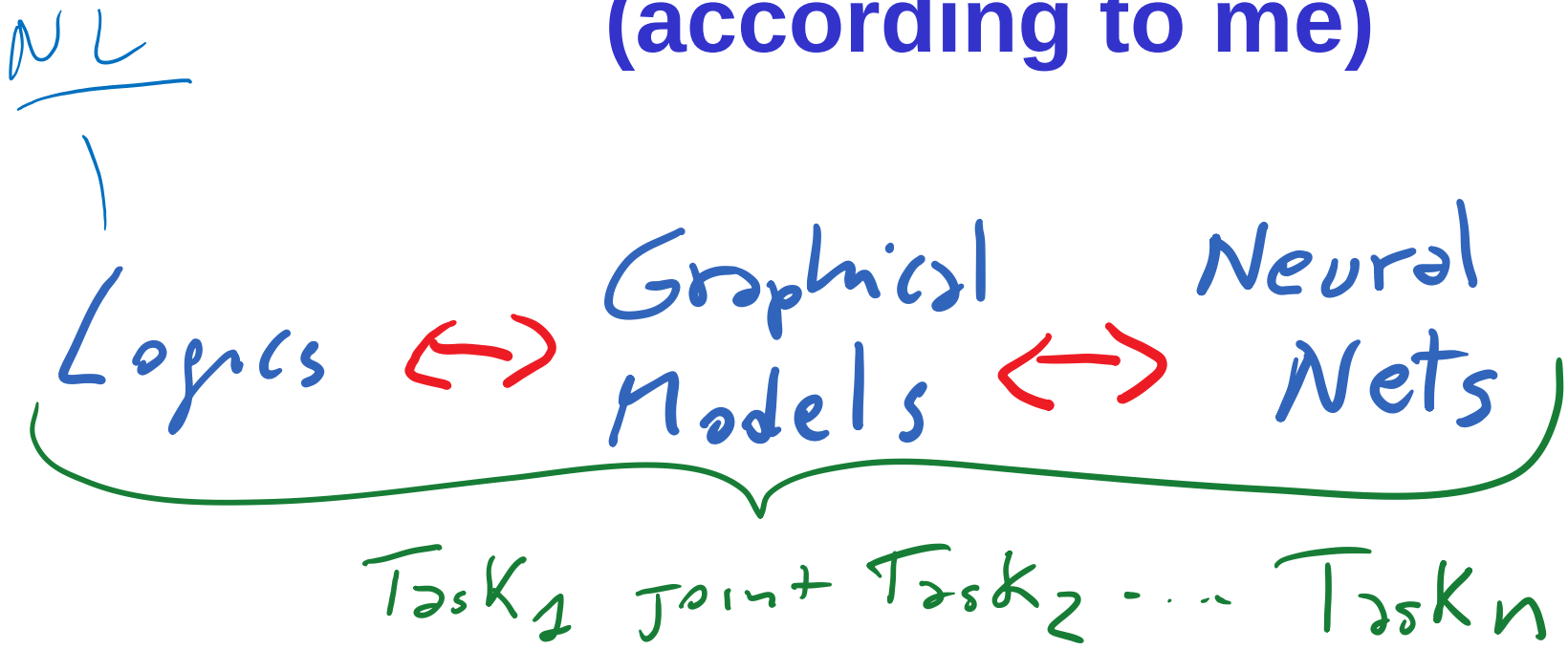
AI R&R&L future in a nutshell (according to me)



How to manage multi-tasking for an increasing number of tasks? **Multi-task**

Machine Translation, Text Summarization, Event recognition in videos

AI R&R&L future in a nutshell (according to me)



How to manage multi-tasking for an increasing number of tasks?

Multi-task R&R&L

In different domains

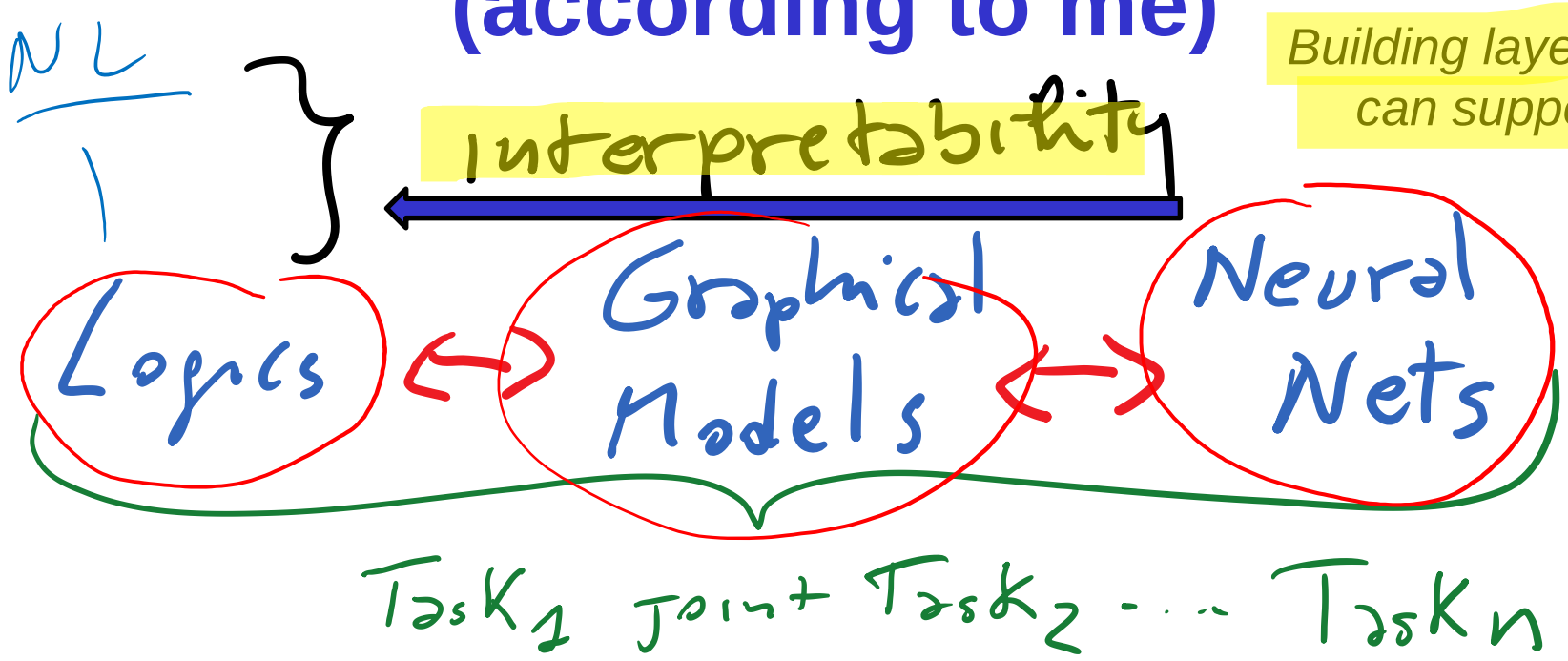
Medicine, Transportation, Politics, Law…

Machine Translation, Text Summarization, Event recognition in videos

Transfer learning

AI R&R&L future in a nutshell (according to me)

Building layers that can support that



How to manage multi-tasking for an increasing number of tasks?

Multi-task

In different domains

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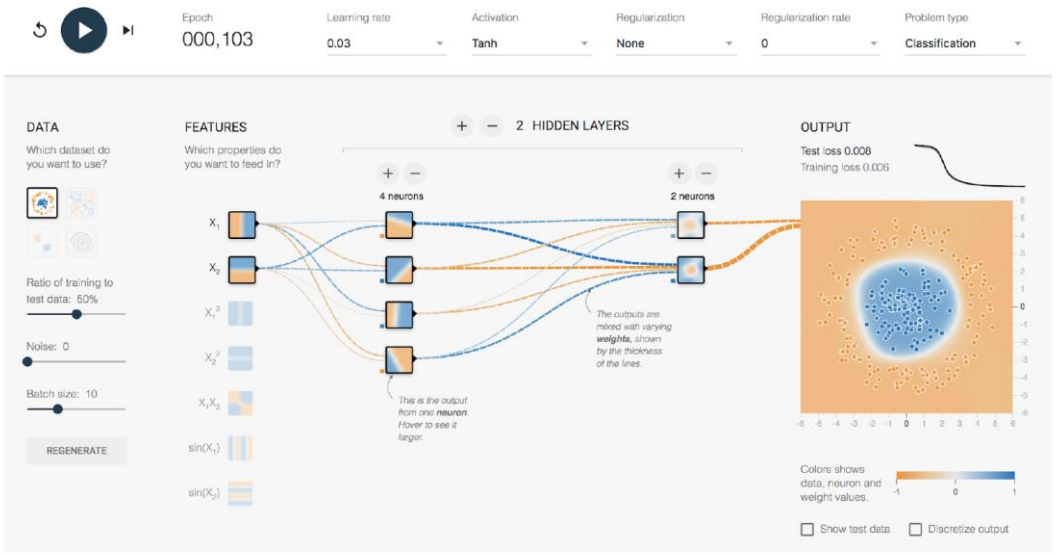
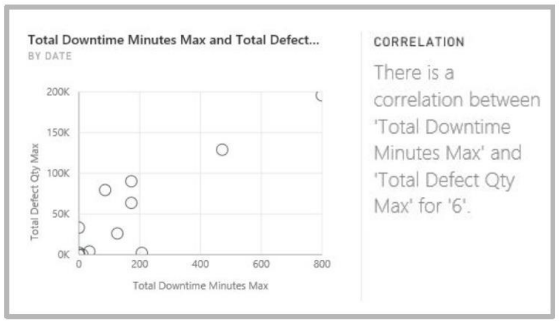
Transfer learning

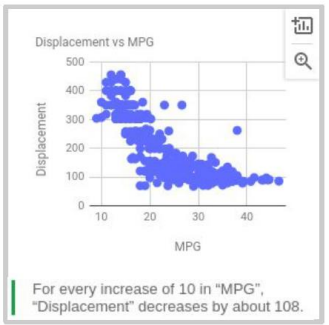
Key to interpretability

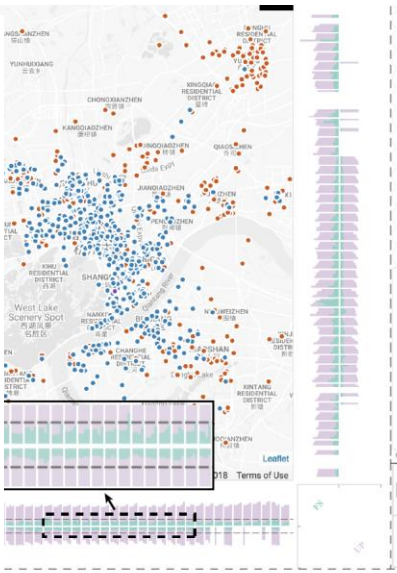
Language +
mathematical
abstractions

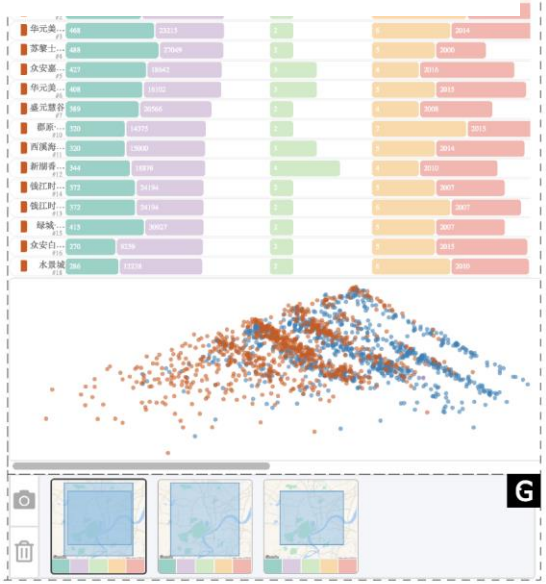
+ Visualization

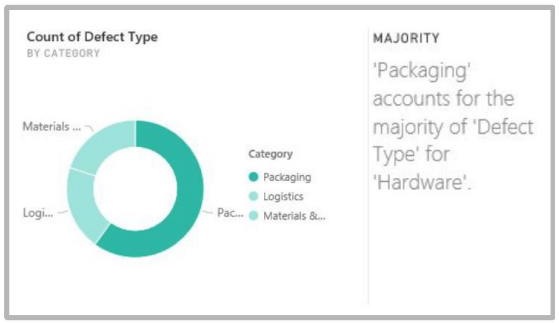


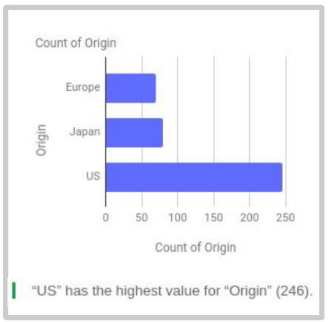












Lecture Overview

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- **(422) Highlights from IUI conferences**
- **Final Exam: how to prepare……**

AI and HCI meet

Keynote Speaker:
Prof. Dan Weld, University of Washington

Intelligent Control of Crowdsourcing

Crowd-sourcing labor markets (e.g., Amazon Mechanical Turk) are booming, …… use of Partially-Observable Markov Decision Processes (POMDPs) to control voting on binary-choice questions and iterative improvement workflows.

… applications range from photo tagging to audio-visual transcription and interlingual translation

Some papers from IUI

Unsupervised Modeling of Users' Interests from their Facebook Profiles and Activities

Preeti Bhargava *(University of Maryland)*
Oliver Brdiczka *(Vectra Networks, Inc.)*
Michael Roberts *(Palo Alto Research Center)*

named entity recognition, document categorization, sentiment analysis, semantic relatedness and social tagging

Semantic Textual Similarity (STS) system [13] for computing the SR scores. STS is based on LSA along with WordNet knowledge and is trained on LDC Gigawords and Stanford Webbase corpora

Some papers from IUI-15

BayesHeart: A Probabilistic Approach for Robust, Low-Latency Heart Rate Monitoring on Camera Phones

Xiangmin Fan *(University of Pittsburgh)*
Jingtao Wang *(University of Pittsburgh)*

BayesHeart is based on an adaptive hidden Markov model, requires minimal training data and is user-independent.

Two models, one with 2 states and one with 4 states, work in combination….

…. measuring people's heart rates through commodity cameras by capturing users' skin transparency changes, color changes, or involuntary motion

Applications: gaming, learning, and fitness training

Paper for IUI 2017

Analyza: Exploring Data with Conversation (Google research)

Applied in two systems

(a) Question answering for a spreadsheet product.

(b) provides convenient access to a revenue/inventory database for a large sales force.....

Support users who do not necessarily have coding skills....

We also derive an additional lexicon for entities in our knowl with a knowl

We use a context-free grammar to parse the annotated query. The grammar rules are wri types.

We used multiple ways of establishing semantic similarity between a question term and the lexicon.

Another IUI 2017 paper

"How May I Help You?": Modeling Twitter Customer ServiceConversations Using Fine-Grained Dialogue Acts

(IBM, U of California..)

Tag	Example
Statement Informative	The signal came back last night [...]
Request Information	Can you send us [...]?
Statement Complaint	Staff didn't honor online info, was dismissive [...]
Question Yes-No	Have you tried for availability at [...]
Statement Expressive Neg.	I don't trust places that do bad installations [...]
Statement Suggestion	Let's try clearing the cache <link> [...]
Answer (Other)	Depends on the responder [...]
Social Act Apology	I'm sorry for the trouble [...]
Social Act Thanks	Thanks for the help [...]
Question Wh-	Why was that?
Statement Offer	We can always double check the account [...]
Question Open	How come I can't get a [...] quote online?
(All Other Acts)	

We develop an **SVM-HMM** model to identify dialogue acts in a conversation, in a real-time setting, and using a novel **multi-label approach** to capture different dialogic intents contained in a single turn.

Last Clicker Question

I would like to learn more about AI....

A. Yes
B. Maybe
C. No

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Final Exam
Time: Sat, Dec 7, 3:30-6 PM
Location: CHBE 101

How to prepare….

- Learning Goals (posted on Connect): Each LG corresponds to one or more possible questions
- Revise all the clicker questions, practice exercises, assignments and midterm !
- Will post more practice material ….
- Office Hours – **Me** Wed 830-10 – TA office hours usual schedule.
- Post Questions on Piazza

Can bring letter sized sheet of paper with anything written on it (double sided)