The Knowledge-Based Stance to AI

A system exhibits intelligent understanding and action at a high level of competence primarily because of the specific knowledge that it can bring to bear.

(Lenat and Feigenbaum, 1991)

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What Are Other Possibilities?

- *General knowledge is sufficient*
- *Control is key (E.g., Hofstadter's parallel terraced scan)*
- *Neither is needed: Emergence (An ant colony)*
- *...*

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Disclaimer: It Isn't All or Nothing

- Understanding AI requires forming your own views on:
  - When is a given stance right
  - How far can we push it
  - Where to place our bets

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A Brief History of Major Trends

- 1970's: Physical symbol system hypothesis; dawn of rule-based expert systems
- 1980's:
  - Rise of rule-based systems companies
  - Retrenchment: Knowledge acquisition and maintenance are hard
  - Explorations of "generic task" methods and start of large-scale knowledge bases (CYC)
- From 1990's:
  - Reusable components and knowledge
  - Focuses on reuse, learning (e.g., CBR) and knowledge sharing (semantic web)
- Today
  - CBR, Analogy, Hybrid systems

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Today Has Unprecedented Opportunities for Knowledge-Based AI

- Resources
  - Large-scale formal knowledge sources
  - Learning systems are augmenting and leveraging them
  - Large-scale informal sources are a resource for mining and "fail-soft" applications
- Needs for explainability
  - Acceptance, especially in high-stakes domains (medicine)
  - Compliance (e.g., in banking, insurance, life science)

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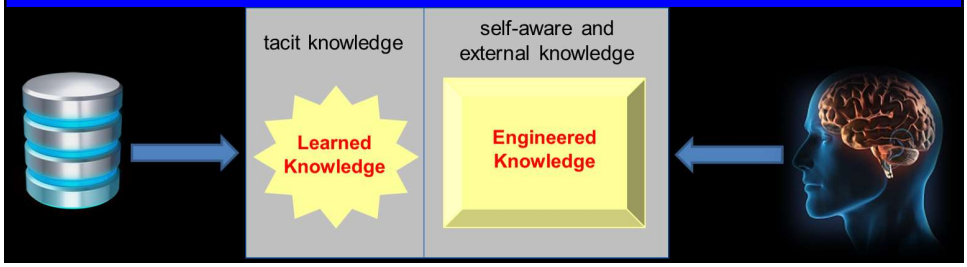
AAAI-MAKE 2021: Combining Machine Learning and Knowledge Engineering

https://www.aaai-make.info/

- "This symposium brings together practitioners and researchers from various companies, research centers, and academia of **machine learning** and **knowledge engineering** working together on joint AI that is being explainable and grounded in domain knowledge"



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Some Key Questions for the Semester

- Knowledge representations
  - What forms can they take?
  - What are the ramifications of different forms?
  - What are the issues and problems for KR?
- Knowledge acquisition/refinement
  - What sources can be harnessed?
  - How can the acquisition process be facilitated?
- Knowledge access and utilization
  - How can knowledge be brought to bear?
  - What power can it give?

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Course Goals

- Provide strong foundation in key principles and techniques of knowledge engineering
- Provide experience and expertise in developing and applying knowledge-based systems, for future research or applications
- Provide an opportunity to do substantial research addressing a current issue
- Further skills in thinking critically, analyzing and presenting research

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Projects

- Topic selection and launch around *mid-semester* (to give tools and ideas for topics)
- Criteria to be discussed in detail then
- Done in small groups
- Products are a program and paper

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Samples of Past Project Areas* (1)

- Knowledge Representation
  - Representation of affect
- Knowledge acquisition
  - Automating Creation of Concept Maps
- Planning
  - A hybrid offensive coordinator for football
  - A case-based opponent predictor for poker
  - Case-based flight control
- Game AI
  - AI for Guardians of Kelthas

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Samples of Past Project Areas (2)

- Creativity/design
  - Drawing
  - Room design
  - Bar-tending
  - Sandwich design
  - Nutritionist for diabetic patients
- Language
  - Sense Disambiguation: Unifying Statistical Methods and Conceptual Structures
  - Generating Unix Commands from Natural Language Requests

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Samples of Past Project Areas (3)

- Intelligent interfaces/support
  - Knowledge-based movie recommender
  - A CBR-based travel assistant
  - Case-based voice communication for a vehicle computer system

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Samples of Past Project Areas (4)

- Search/Categorization
  - Query clustering using OpenMind/Commonsense and OpenCyc
  - Genome annotation using CBR
  - Using CBR to boost IR performance
  - Intelligent Search for K-12 Teachers and Graders

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During the Coming Weeks We'll Address Many Issues that Could Lead to Projects

Keep on the Lookout for Topics That Interest You!

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