(Biased) Overview of A.I. Topics

David I. Inouye
High-Level Categorization of AI Topics

1. Artificial Intelligence (other than topics below)
3. Computer Vision
4. Natural Language Processing
1. Artificial Intelligence (Based on AAAI topic list)

- Cognitive modeling and systems
- Constraint Satisfaction/ Optimization
- Game theory
- Human + AI
- Knowledge representation and reasoning
- Robotics
AI: Cognitive Modeling

- Models of human/animal cognition
- Based on psychological theory and experiments
- 2 Goals
  - AI -> Cognitive Science: Understand/test underlying cognitive mechanisms by computational modeling
  - Cognitive Science -> AI: Improve computational methods via insights from cognitive science

David I. Inouye
AI: Constraint Satisfaction / Heuristic Optimization

- Eight queens puzzle
- Map coloring problem
- Real-world
  - Resource allocation
  - Scheduling
AI: Game Theory

- Prisoner’s dilemma

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THE PRISONER’S DILEMMA

<table>
<thead>
<tr>
<th></th>
<th>B stays silent (cooperates)</th>
<th>B betrays A (defects)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A stays silent (cooperates)</td>
<td>Both serve 1 year</td>
<td>A serves 3 years, B goes free</td>
</tr>
<tr>
<td>A betrays B (defects)</td>
<td>A goes free, B serves 3 years</td>
<td>Both serve 2 years</td>
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- Real-world
  - Google Ads bidding
  - Connections to “Generative Adversarial Networks”
AI: Human + AI

- Crowdsourcing
  - “Stop spam, read books”

- Human-robot interactions

AI: Knowledge representation and reasoning

- Knowledge graphs

  ![Knowledge Graph Diagram]

  - Did Alec Guinness ever play a Science Fiction character?


- Inferences in knowledge graphs
  - Did Alec Guinness ever play a Science Fiction character?
2. Machine Learning (based on NeurlIPS Topics)

- Learning with limited labels
- AutoML / Meta-learning
- Generative / probabilistic models
- Reinforcement learning
- Explainable AI
- Domain Generalization
ML: Learning with limited labels

▸ Active learning

▸ Few-Shot Learning

Dataset

Classes with many samples

Classes with few samples

Classifier

Labeled Data

Machine Learning Model

Pool of Unlabeled Data

Label for Difficult Point

Point That is Difficult for Machine

https://medium.com/sap-machine-learning-research/deep-few-shot-learning-a1caa289f18

https://blog.cloudera.com/a-guide-to-learning-with-limited-labeled-data/
ML: AutoML / Meta-learning

https://cloud.google.com/automl-tables/?hl=vi
ML: Generative/Probabilistic Models

Density estimation / Graphical Models

The Student Network

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<th>$d^1$</th>
<th>$i^0$</th>
<th>$i^1$</th>
<th>$s^0$</th>
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ML: Generative Adversarial Networks (GAN)

- Generative Adversarial Networks (GAN)
  - Image to image translation via GANs


ML: Reinforcement Learning

- Game playing

- Bandit algorithms (simpler form of RL)
  - Which Google search result should I show?
ML: Explainable AI

Why model explanations?
Accuracy is insufficient for many applications

- Loan approval: “Could the model make a catastrophic mistake?”
- Self-driving cars: “Does the model obey common sense intuitions?”
- Bail decisions: “Is the model biased because of historical discrimination?”
- Healthcare: “Does the model agree with doctor’s knowledge?”
- Military strategy: “How will the model perform in adversarial settings?”
ML: Domain Generalization

- Distribution shifts in the real-world

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Domain generalization</th>
<th>Subpopulation shift</th>
<th>Domain generalization + subpopulation shift</th>
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- How can you train models so that they work in new unseen test domains?

3. Computer Vision (Based on CVPR sessions)

▸ Classic tasks

▸ 3D Multiview / Depth estimation

▸ Synthesis
CV: Classic Tasks

- Recognition

- Segmentation


http://vladlen.info/publications/feature-space-optimization-for-semantic-video-segmentation/
CV: 3D Multiview / Depth estimation

https://vision.in.tum.de/research/image-based_3d_reconstruction/multiviewreconstruction

CV: Image / Video Generation (Synthesis)

- **Style transfer**
  

- **Sketch to draw**
  
4. Natural Language Processing (based on ACL 2019 Call for Papers (CFP))

▸ Tagging and Parsing
▸ Information Extraction and Text Mining
▸ Dialogue Systems / Question Answering
▸ Applications
  ▸ Summarization
  ▸ Sentiment Analysis
  ▸ Machine Translation
NLP: Ambiguity is huge challenge in NLP

Lexical Ambiguity
The presence of two or more possible meanings within a single word.

"I saw her duck."

Syntactic Ambiguity
The presence of two or more possible meanings within a single sentence or sequence of words.

"The chicken is ready to eat."

https://www.thoughtco.com/ambiguity-language-1692388
NLP: Tagging and Parsing
NLP: Information Extraction and Text Mining

Text in

Brazil ranks number 5 in the list of countries by population.

The term "Ibu Negara" (Lady/Mother of the State) is used for wife of the President of Indonesia.

Game of Thrones is an adaptation of A Song of Ice and Fire, George R. R. Martin’s series of fantasy novels. It ranks fourth among the IMDB Top Rated TV Shows.

Data out

The countries with the largest population:
- China: 1,388,232,693
- India: 1,342,512,706
- United States: 326,474,013
- Indonesia: 263,510,146
- Brazil: 174,315,386

The country’s first ladies:
- Brigitte Macron: Spouse: Emmanuel Macron, President of France (2017 -)
- Melania Trump: Spouse: Donald J. Trump, U.S. President (2017 -)
- Iriana Widodo: Spouse: Joko Widodo, President of Indonesia (2014 -)

Also known as: "Ibu Negara" (Lady/Mother of the State)

IMDB Top Rated TV Shows:
1. Planet Earth II (2016): 9.6
4. Game of Thrones (2011): 9.4

https://www.ontotext.com/knowledgehub/fundamentals/information-extraction/
NLP: Topic Models

NLP: Dialogue Systems / Question Answering

ChatGPT is at capacity right now

Get notified when we're back

Explain the status of ChatGPT in the style of Shakespeare.

Ah, dear user of ChatGPT, thou art not alone in thy desire to engage with our esteemed AI chatbot. Many have flocked to our website in this hour, and we do our utmost to accommodate each and every one. Yet, alas, our resources are not without limit and we must ask for thy patience and forbearance. In time, we shall be able to provide thee with access to ChatGPT. Until then, we beg thee to return at a future juncture, when we may better serve thy needs. Until then, we bid thee adieu and good fortune.

Benedict Anderson and Ernest Gellner both have theories about the origins and nature of nationalism, but their perspectives differ in key ways. Anderson believes that nationalism is a cultural construct, arising from the development of print capitalism and the creation of imagined communities. Gellner, on the other hand, sees nationalism as a product of modernization and industrialization, with nations being formed as a means of organizing society and providing a shared identity.

One key difference between the two theories is the role of culture. For Anderson, culture is central to the creation of nationalism, as the spread of print media allows for the creation of imagined communities that transcend physical boundaries. This allows for the development of a national identity based on shared cultural experiences and practices. In contrast, Gellner downplays the importance of culture in the formation of nationalism, arguing that it is primarily a function of economic and political developments. He sees nations as being formed in response to the need for a shared identity and sense of belonging in an industrialized society.

Another point of contrast is the emphasis on agency. Anderson’s theory suggests that people actively participate in the construction of national identity, through their engagement with print media and other cultural practices. In contrast, Gellner’s theory emphasizes the role of external factors in shaping national identity, with individuals being passive recipients of the national identity imposed on them by the forces of modernization.

Overall, while both Anderson and Gellner provide valuable insights into the origins of nationalism, their theories offer different perspectives on the role of culture and agency in the formation of national identity. Anderson emphasizes the cultural construction of nationalism, while Gellner sees it as a product of modernization and industrialization. Both theories offer valuable insights into the complex process of national identity formation, and can be useful in understanding the dynamics of nationalism in different historical contexts.
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