Lecture 3

Analytical Learning Discussion (1 of 4): Explanation-Based and Inductive Learning in ANNs

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Readings:
Chapter 21, Russell and Norvig
"Integrating Inductive Neural Network Learning and Explanation-Based Learning", Thrun and Mitchell

Presentation Outline

- Paper
  - "Integrating Inductive Neural Network Learning and Explanation-Based Learning"
  - Authors: S. B. Thrun and T. M. Mitchell
- Overview
  - Combining analytical learning (specifically, EBL) and inductive learning
    - Spectrum of domain theories (DTs)
    - Goals: *robustness, generality, tolerance for noisy data*
  - Explanation-Based Neural Network (EBNN) learning
    - Knowledge representation: artificial neural networks (ANNs) as DTs
    - Idea: track changes in goal state with respect to query state (*bias derivation*)
- Topics to Discuss
  - Neural networks: good substrate for integration of analytical, inductive learning?
  - How are goals of robustness and generality achieved? Noisy data tolerance?
  - Key strengths: approximation for EBL; using domain theory for bias shift
  - Key weakness: how to *express* prior DT, *interpret* explanations?
- Example Paper Reviews: Online (Course Web Page)

Background AI and Machine Learning Material

- Explanation-Based Learning
  - Russell and Norvig
    - Chapter 18: inductive learning
    - Section 21.2: symbolic EBL
  - Mitchell
    - Chapter 4: artificial neural networks (ANNs)
    - Chapter 11: analytical learning
    - Chapter 12: integrating analytical and inductive learning
- Quick ANN Review
- Topics to Discuss
  - Muddiest points
    - Inductive learning
    - ANNs
    - Analytical learning
    - EBNN
  - What kind of questions to ask when writing reviews and presentations

EBNN: Issues Brought Up by Students in Paper Reviews

- Key EBNN-Specific Questions
  - Generalization to other DT inducers (many)
  - Generalization to other problems (Yuhong Cheng)
  - What kind of knowledge are slopes? (many)
  - ANN training cost and complexity (Yue Jiao)
  - *Does EBNN really provide noise tolerance? How so? (Haipeng Guo)*
  - *When/why might LOB* hold? (Haipeng Guo, Yibin Zhan)*
- Key General Questions
  - *What other kinds of knowledge can we use? (Jayaraman Prasanna, others)*
  - *Analytical / inductive learning tradeoffs (Yue Jiao)*
  - *How to incorporate prior knowledge? (Jayaraman Prasanna)*
- Other Important Questions
  - Propositional vs. FOPC DT (Chung-Hai Dai, others)
  - *Issues not discussed: incrementality, situated learning (Jayaraman Prasanna)*
- Applications

Key Strengths of EBNN

- Strengths
- Applications

Key Weaknesses of EBNN

- Weaknesses
- Unclear Points

Terminology

Summary Points