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 weaknesses: 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

Key Strengths of EBNN

• Strengths

• Applications

Key Weaknesses of EBNN

• Weaknesses

• Unclear Points

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
Terminology

Summary Points