AAA Introduction to CP-nets

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INTRODUCTION

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Conditional Preferences

- If I attend two tutorials today, I would prefer to skip the Ethics & AI workshop tomorrow, but if I only attend one tutorial, I prefer to attend the workshop.
- I prefer to attend the CP-nets tutorial, rather than sleeping in today.
- I prefer to explore Phoenix this afternoon.
Visualizing my preferences

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Day
Attend CP-Nets Tutorial > Sleeping In

Explore
Yes > No

Tutorials
One > Two

Ethics WS
O: Attend > Skip
T: Skip > Attend
Pasta at Monday Night’s Reception

- Bowtie, Penne
- Tomato (Red) sauce, White sauce
- Cheese
- Mushrooms
- Peppers
- Other toppings

- What are your preferences?
The CP-Net Visualizer by Shafran and Saarinen

- Using the CP-net visualizer
Check out the CP-net Visualizer demo at the Monday night reception!

Aidan Shafran  Sam Saarinen
CP-Net Visualizer for download

- Github.com/zelbrium/cp-net-visualizer
  - Aidan Shafran and Sam Saarinen
Formal Definition of CP-Nets

- CP-nets are qualitative representations of preferences.
- A CP-net consists of a graph, where nodes represent preference variables or features of possible outcomes, plus conditional preference tables for each node.
  - Boutilier, Brafman, Hoos, Poole. Reasoning with conditional ceteris paribus preference statements. UAI. 1999
- A CP-net defines a partial order on outcomes.
A Few CP-Net Applications

- Facilitating communication with “shut-ins” with traumatic brain injury or ALS
  - Dorr, Galescu, Golob, Venable, Y Wilks. *Companion-Based Ambient Robust Intelligence (CARING)*. Workshops at AAAI 2015.

- Interest matching in social networks
A Few CP-Net Applications

- Web service selection

- Choosing security measures
Multi-Agent CP-Net Applications

- Automated negotiation
Multi-Agent CP-Net Applications

- **Auctions**

- **Collective decision making**
What Can CP-Nets Compute?

- What is the most preferred item?
  - *Penne with red sauce and cheese?*

- What are the k most preferred items?
  - *In case they run out of something, or have pre-prepared dishes*

- Which of these two is preferred?
  - *<Bowtie, Red, NoCheese> or <Penne, White, NoCheese>?*

- If o is preferred to o’, we say that o **dominates** o’.
Computational Complexity

■ Finding the best or $k$ best is in P.

■ Dominance is NP-hard.
  – *Boutilier Brafman, Domshlak, Hoos, Poole. CP-nets: A tool for representing and reasoning with conditional ceteris paribus preference statements. JAIR. 2004.*

■ Dominance in generalized CP-nets is PSPACE-complete [allowing cycles in CP-net graph, multi-valued variables, and succinct representations of CPTs]