Game theoretic learning using the imprecise Dirichlet model

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My promoter, myself and my research

- Presented research: master’s thesis cont’d
- PhD-research started last fall
- Current research: Using the IDM for learning in Markov models
- Research interests: the IDM and its applications, learning models
- Research detour: imprecise central moments
Two players in strict competition, but hey, it’s only a game

- Yourself and one opponent
- His loss, your gain (and vice-versa)
- Playing: choosing a strategy
- Afterwards: the pay-off, positive or negative
- Strategies: from pure to mixed
- The expected payoff
Model your uncertainty, take an IDM

- You, the player, think/suppose that your opponent plays an unknown, fixed, strategy
- Why uncertainty in the model: to allow you to make an informed strategy choice yourself
- Model with: a PDM or, more general, an IDM
Updating the IDM

- Gathering information: observing the pure strategies your opponent plays
- Update your IDM with the gathered observations
To play, we need to pick an optimal strategy

- Optimal: maximise immediate expected pay-off, perhaps minimise risk (limit losses)
- Use IDM and pay-off function to order the gambles
- One optimal strategy or a set of optimal strategies (partial order)
- Optimal set: no further choice, but an arbitrary one
One opponent, one game, playing over and over again

- Equilibrium of a game: special couple of strategies, if only you change your strategy, you’ll get less (idem for your opponent)
- In some cases, for a special type of equilibrium, convergence to such an equilibrium is guaranteed
- In all cases, if the played strategies converge, it is to an equilibrium
Conclusions

- What we did: generalise a learning model, replacing PDM by IDM, complete ordering of strategies by a partial ordering
- The resulting learning model has similar properties with regard to convergence to equilibria
- We obtain a more complex, but also more expressive learning model
Questions: fire away

Slide reference:

1) Presenting myself and my research
2) Defining games: strategies and pay-off
3) Modelling uncertainty: IDM
4) Updating an IDM
5) Optimal strategies
6) Convergence to equilibria
7) Conclusions