TAC Price Prediction

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Why predict closing hotel prices?
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- Choice of flights depends on hotel prices on the included travel days
- Compute accurate bid prices for hotels
How can we predict the hotel prices?
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- Just use current price quote
- Adjust current price quote using historical data
- Fit a curve to price points seen in current game
- Predict based on closing prices from past games
- Utilize hotel closing times with historical information on price predictions
- Learn a mapping of features from the current game to closing prices based on historical data
- Hand construct rules based on associations between abstract features
How can we predict the hotel prices?

- **Historical data**
  - Based on historical averages and past closing prices

- **Current game data**
  - Based on known data of current game

- **Mix of historical and current data**
  - Models built on historical data to map current game features to closing prices
What data is most relevant for price prediction?
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- Historical price averages
- Current price quotes
- Flight prices
- Opponent profiles
- Client demand
Initial vs. Interim Price Predictions

- Initial Price Predictions
  - Beginning of the game
  - Before any hotel price information has been received

- Interim Price Predictions
  - Includes quotes from ongoing hotel auctions
  - Ongoing revision of predictions as auctions close
How can we predict hotel prices initially using current game data?
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- Initial flight prices
- Identity of agents
- Neural Networks
- Boosting algorithms
- Competitive Equilibrium Analysis
How would the flight prices affect the hotel prices?
How would the flight prices affect the hotel prices?

- More hotel demand expected during days with cheaper flights

<table>
<thead>
<tr>
<th>Flight</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
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</thead>
<tbody>
<tr>
<td>Incoming</td>
<td>100</td>
<td>50</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Outgoing</td>
<td>100</td>
<td>100</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>
One Example: kavayaH

- Separate neural network for each hotel
- Trained using back-propagation
- Inputs are thresholded differences between flight prices on adjacent days
- Output is a discrete set of prices based on historical prices
Comparison of initial price prediction strategies in TAC02

- **Historical Predictors**
  - The best these predictors can hope to do is predict the average closing price over a series of games

- **Current Game Predictors**
  - ATTac, kavayaH, walverine
  - Significantly better than historical game predictors