UT Austin Villa: A Machine Learning Approach for Kicking and Passing

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Topics

- How to approach and kick the ball to different targets
- Where to kick the ball
- When to kick the ball
- How to have teammates move to receive a pass
How to approach and kick the ball to different targets

- Optimize parameters using CMA-ES
- Independently learn walk for approaching/stopping next to ball and for kicking the ball from a fixed position
- Relearn a subset or overlap of parameters for the walk approach and kick skills through an overlapping layered learning approach to combine them
- Learn kicks for different distances
Where to kick the ball

Kick locations with lighter circles having a higher score. Selected location shown in red.

- Evaluate possible kick locations and select highest value location
  - opponents close
  - teammates close
  - moves ball closer to opponent’s goal

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When to kick the ball

- **Train logistic regression classifier** to predict probability of success

- **Use 35 different features including:**
  - Angle and distance to ball
  - Nearest opponents’ angles, distances, orientations, and velocities relative to ball

- **Sample probability thresholds and play 100s of games to evaluate**
  - Average goal differential
  - Number of kicks
  - Goals against
  - Probability of tie/loss

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How to have teammates move to receive a pass

- **Kick anticipation** where players move to projected destination of the ball after the kick
- **SCRAM role assignment** selects players to move to receive pass
- Teammates **avoid path of ball** right before it is kicked

purple path of ball, magenta avoid path, light blue anticipated positions
Keepaway team in yellow maintains possession for over two minutes against 2014 champion UT Austin Villa released binary in orange
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