Predicting Wide Receiver Trajectories in American Football

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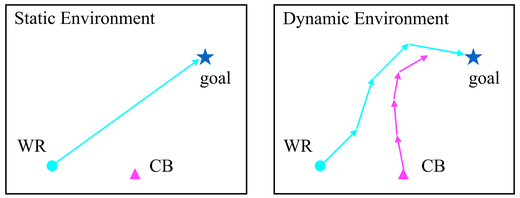
Overview

- Computational model of the wide receiver, with prior knowledge about the game and short-term predictive models of changes in environment
- Prediction of viable paths for the wide receiver, using a sequential inference procedure based on inverse optimal control

- Motivation

Kitani et al. ECCV'12



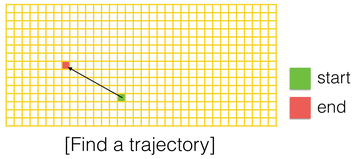
The path of a wide receiver will change depending on the changes in environments.

- Problem setup

Goal : Predict wide receiver trajectories with scene dynamics
Input : 1) image at the start, 2) output of a player detector
Output : predicted distribution of all future path

*We assume a moving defender on the wide receiver.

Modeling of Player Activity

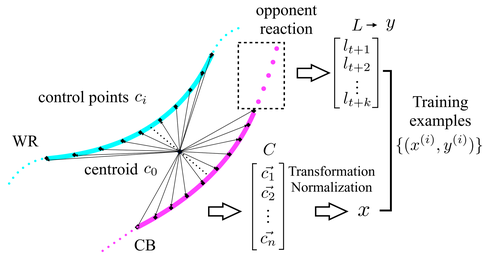


[Find a trajectory]

- Markov Decision Process
  : sequential decision making
- Inverse Optimal Control
  : recover reward weights from demonstrated examples

Modeling of Dynamic Environments

- Use feature regressors to estimate the changes in environments
  1) Non-linear feature regressor (Gaussian process regression)
  2) Linear feature regressor (constant motion)



Sequential Inference in Dynamic Environments

- Dynamic reward function

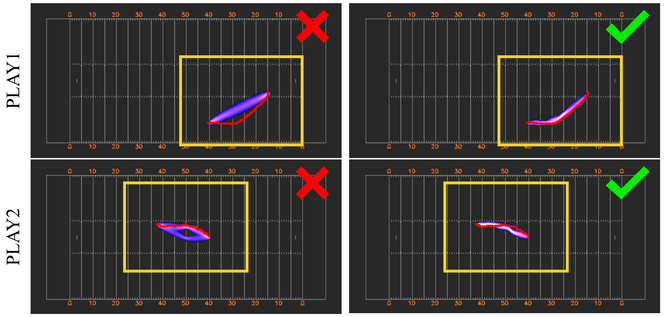
$$r_t(s;\boldsymbol{\theta}) = r(s;\boldsymbol{\theta}_s) + r_t(s;\boldsymbol{\theta}_d)$$

total reward | static reward | dynamic reward

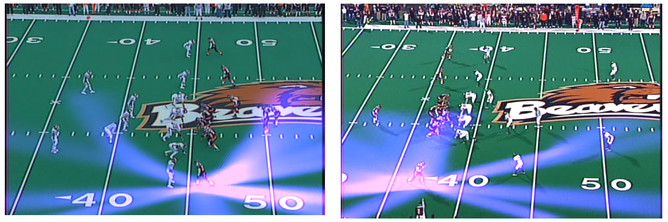
$\boldsymbol{\theta}_s$: weights for the static features
$\boldsymbol{\theta}_d$: weights for the dynamic feature

- Multiple short-term predictions while updating dynamic features

Forecasting Results



Destination Forecasting Results



Conclusion

- Dynamic feature regression techniques within an optimal control framework are developed to predict possible alterations in visual environments.
- It is demonstrated that a careful design in the strategic role of an agent, plus modeling the changes of environment in a sequential inference scheme enables successful play forecasting in dynamic environments.

Acknowledgement

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