

# An application of dynamic programming in American football

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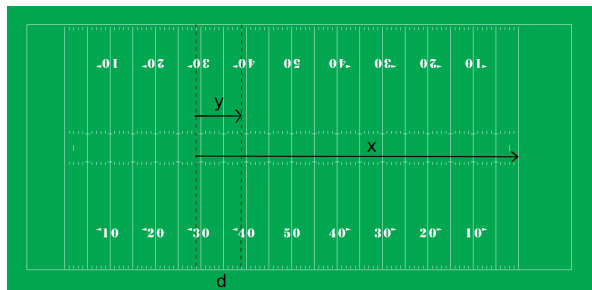
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# The Football Model



- States:  $(x_i, y_i, d)$ , 15250 total states
- Actions: (P, R, U, K)
- Rewards: TD = 6.8, FG= 3, S= -2, Off Ex =  $-\frac{6.8x}{100}$
- Aim: Find the optimal policy

## DP Equation

$$\mu^k(i) = \arg \max_{u \in U} \left[ \sum_{j \in S} p_{ij}(u) (g(i, u, j) + J^{\mu^{k-1}}(j)) \right]$$

Note: In reality  $J$  is difficult to compute, instead we use  $\tilde{J}$ .

# Heuristic Algorithm

- We create a reasonable class of policies and implement it.
- Policies are compared by calculating the points from one drive.
- Simulations are run from the starting state of  $(x_i, y_i, d) = (80, 10, 1)$ .

# API and OPI Policy Updates

- API: Many training sample points, few iterations
- OPI: Few training sample points, many iterations