Play Type Recognition in Real-World Football Video

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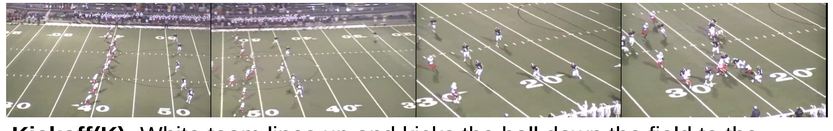
Problem Statement:

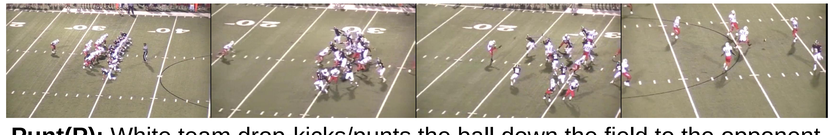
Input: A sequence of temporally ordered videos comprising all plays from a football game.

Output: A labeling of each play by one of the five play types (O, D, K, P, F).

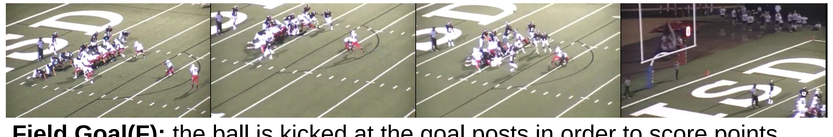
Offense/Defense(O/D): White team is trying to move the ball forward (O). Black team is trying to prevent the other team from moving the ball forward (D).



Kickoff(K): White team lines up and kicks the ball down the field to the receiving team.



Punt(P): White team drop-kicks/punts the ball down the field to the opponent.



Field Goal(F): the ball is kicked at the goal posts in order to score points.

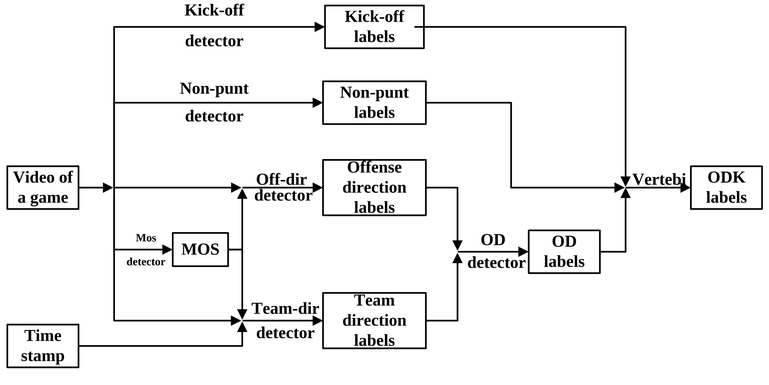
Challenge:

Big dataset with lots of **variations**.

Big: There are **1463** test videos from 10 full games spanning **5.44 hrs**.
Variations: Field, view point, uniform color, camera work quality

System Overview:

Partial Rectification: Field lines are extracted, providing a partial frame of reference for the football field.
Play-level recognition: Noisy play-type detectors are run for a subset of the play types
Game-level reasoning: A temporal model of football games is used to reason about the noisy detections across the full sequence.



Results:

Dataset	TD*	WR*	OD*	TD	WR	OD
Game01	1.00	0.97	0.97	0.94	0.83	0.80
Game02	0.99	0.84	0.84	0.98	0.80	0.82
Game03	1.00	0.85	0.85	0.99	0.76	0.76
Game04	0.89	0.79	0.71	0.91	0.62	0.62
Game05	0.96	0.83	0.81	0.90	0.77	0.71
Game06	0.99	0.86	0.85	0.99	0.79	0.78
Game07	0.90	0.66	0.63	0.90	0.63	0.63
Game08	0.98	0.93	0.92	0.94	0.92	0.87
Game09	0.97	0.93	0.91	0.99	0.93	0.92
Game10	0.97	0.89	0.87	0.97	0.82	0.80
Overall	0.97	0.85	0.84	0.95	0.79	0.77

Acc for OD detector, * indicates using ground truth MOS

Dataset	$Prec_{ko}$	$Recall_{ko}$	$Prec_{np}$	$Recall_{np}$
Game01	100.00%	88.89%	97.30%	90.00%
Game02	75.00%	75.00%	100.00%	73.33%
Game03	100.00%	90.00%	100.00%	78.31%
Game04	100.00%	83.33%	100.00%	76.06%
Game05	90.00%	75.00%	96.52%	86.72%
Game06	80.00%	100.00%	100.00%	83.33%
Game07	78.57%	100.00%	99.17%	80.95%
Game08	61.54%	88.89%	96.99%	87.76%
Game09	100.00%	100.00%	98.02%	83.19%
Game10	85.71%	85.71%	97.56%	56.74%
Overall	85.41%	88.17%	98.57%	79.41%

Result of Kick-off (ko) and Non-punt (np) detectors

Dataset	GT_{all}	$GT_{\emptyset}$	GT_{mos}	GT_{od}	GT_{ko}	GT_{np}
Game01	0.98	0.79	0.94	0.95	0.81	0.81
Game02	0.99	0.85	0.83	0.92	0.88	0.85
Game03	0.98	0.74	0.78	0.94	0.72	0.82
Game04	0.99	0.65	0.76	0.96	0.62	0.71
Game05	0.99	0.72	0.83	0.93	0.77	0.76
Game06	0.99	0.82	0.85	0.96	0.82	0.90
Game07	0.99	0.69	0.71	0.98	0.69	0.75
Game08	0.98	0.77	0.87	0.92	0.81	0.83
Game09	0.98	0.84	0.89	0.96	0.84	0.93
Game10	0.98	0.67	0.91	0.93	0.70	0.85
Overall	0.99	0.77	0.83	0.95	0.79	0.85

Acc for each game. Subscript indicates the ground truth information used, Second column shows the acc for the fully automatic system

Running Time: 2x game length