

OASiS: Off-the-ball Action Significance Score

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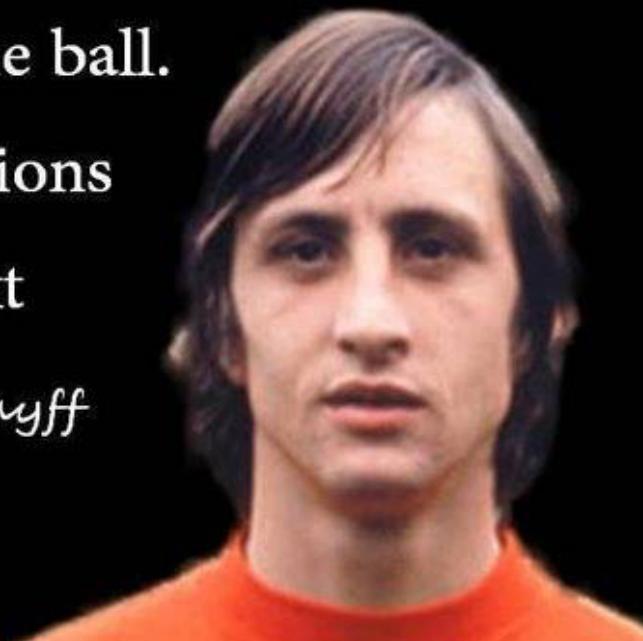
10 players, 1 ball

- Only <10% of the time you touch the ball

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“In most scenarios it isn’t the man on the ball who decides where the ball goes, but players without the ball. Their running actions determine the next pass.” - *Johan Cruyff*



Off the ball movement is important



(youtube)

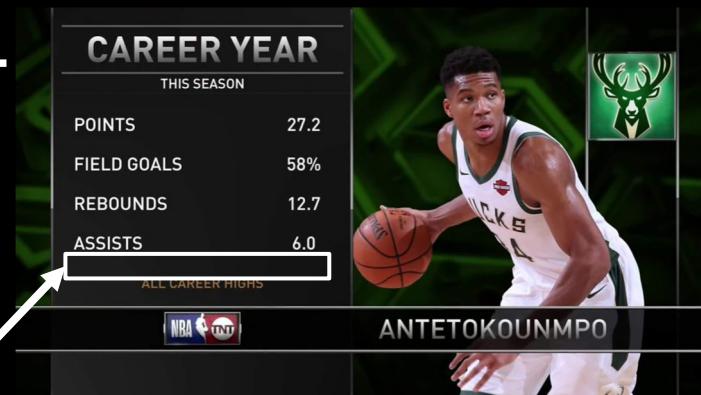
Off the ball movement is important



(youtube)

However, we evaluate players by ...

- Number of shots / shot accuracy
- Assists, dribble success ...



(nba.com)

What about off-the-ball creativity?

OASiS: Off-the-ball Action Significance Score

- For each action of a player NOT having the ball, we score the consequence of the action

A_t : Action starting at time t

C_t : Consequence (e.g. 3pt / turnover) right after A_t

$S_{(C_t)}$: Significance score of the consequence

OASiS: Off-the-ball Action Significance Score

- Integrate all the actions in a certain time period (e.g. 1 game) to get the final significance score

A_t : Action starting at time t

C_t : Consequence (e.g. 3pt / turnover) right after A_t

$S_{(C_t)}$: Significance score of the consequence

$$OASiS_{[t_1, t_2]} = \sum_{t \in [t_1, t_2]} A_t \cdot S_{(c_t)}$$

Dataset:

- Player and ball location
(2 mm spatial and 0.01 second time resolution)

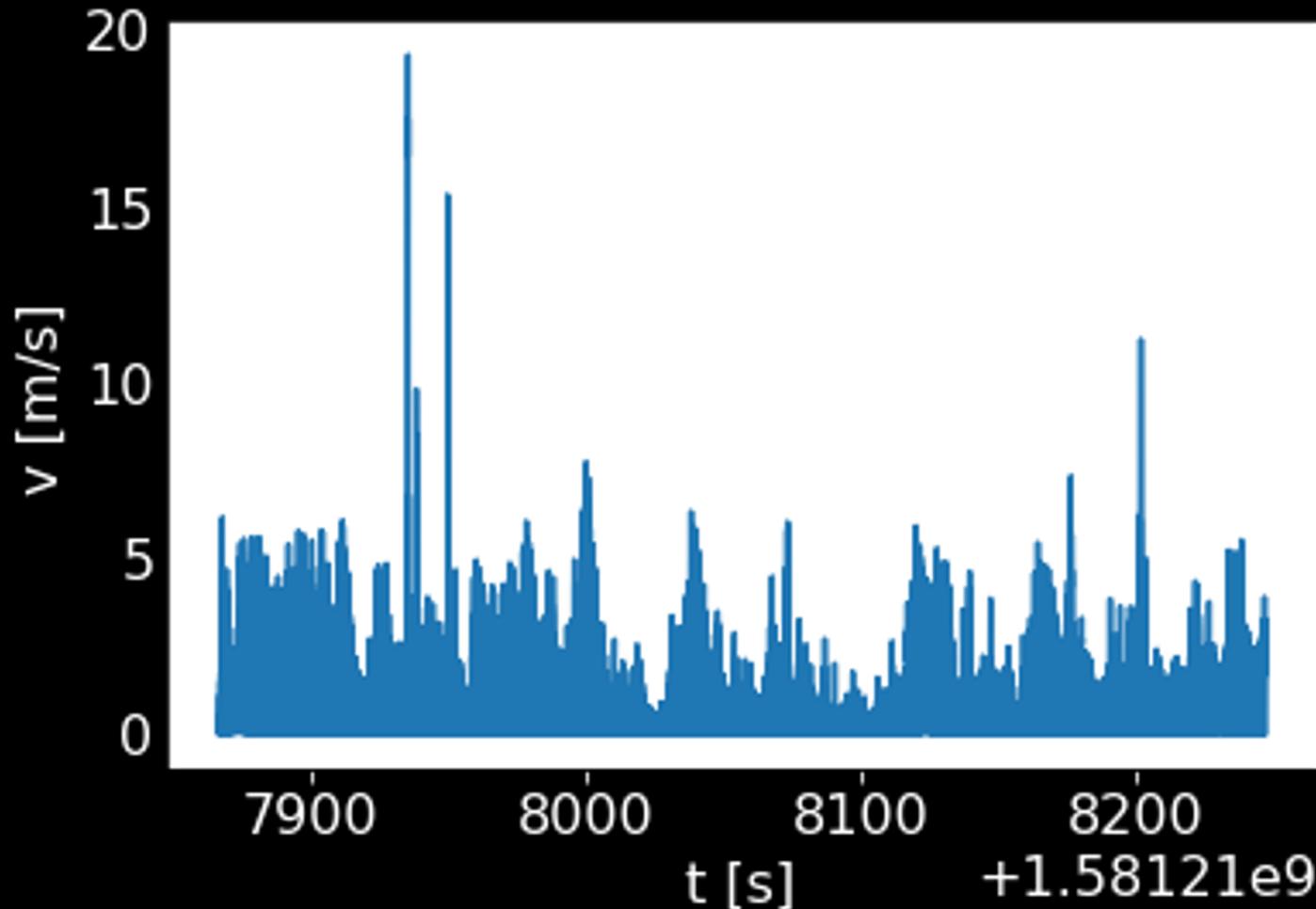
timestamp	playerID	x	y	z	
1581217867099	67348	-423	-507	1824	
1581217867108	67348	-423	-507	1824	...
1581217867116	67348	-421	-505	1836	
⋮					

- Events log with timestamp (e.g. score / foul)

	Timestamp	TeamId	FG2	FG3	PASS6	
0	1581217876835		1714	1		
1	1581217907694		1713		1	...
2	1581217907694		1713		1	
⋮						

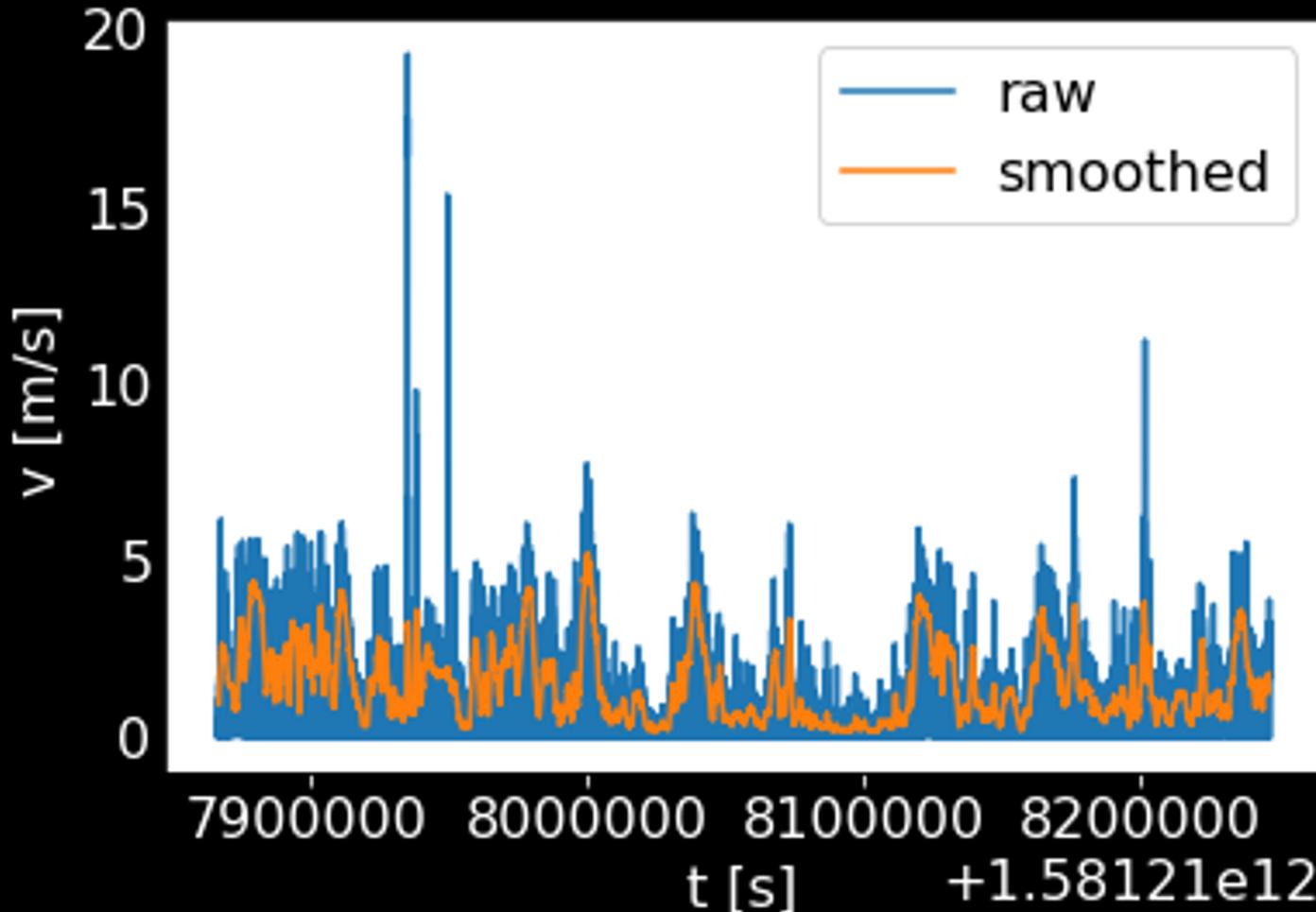
Extracting the off-the-ball action

1. Plot the velocity of each player (e.g. ID 67351)



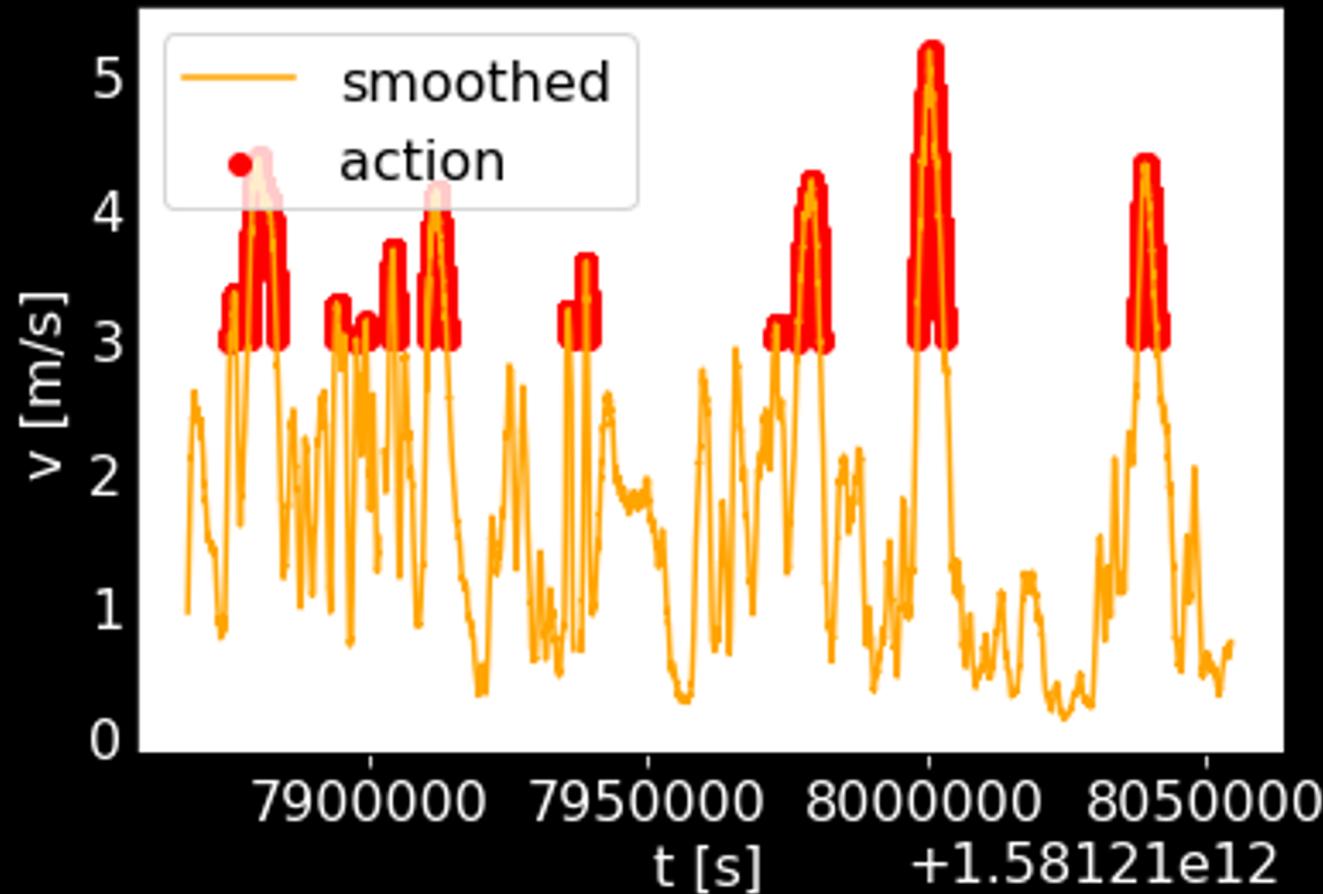
Extracting the off-the-ball action

2. Make it smooth (rolling window, 0.1second)

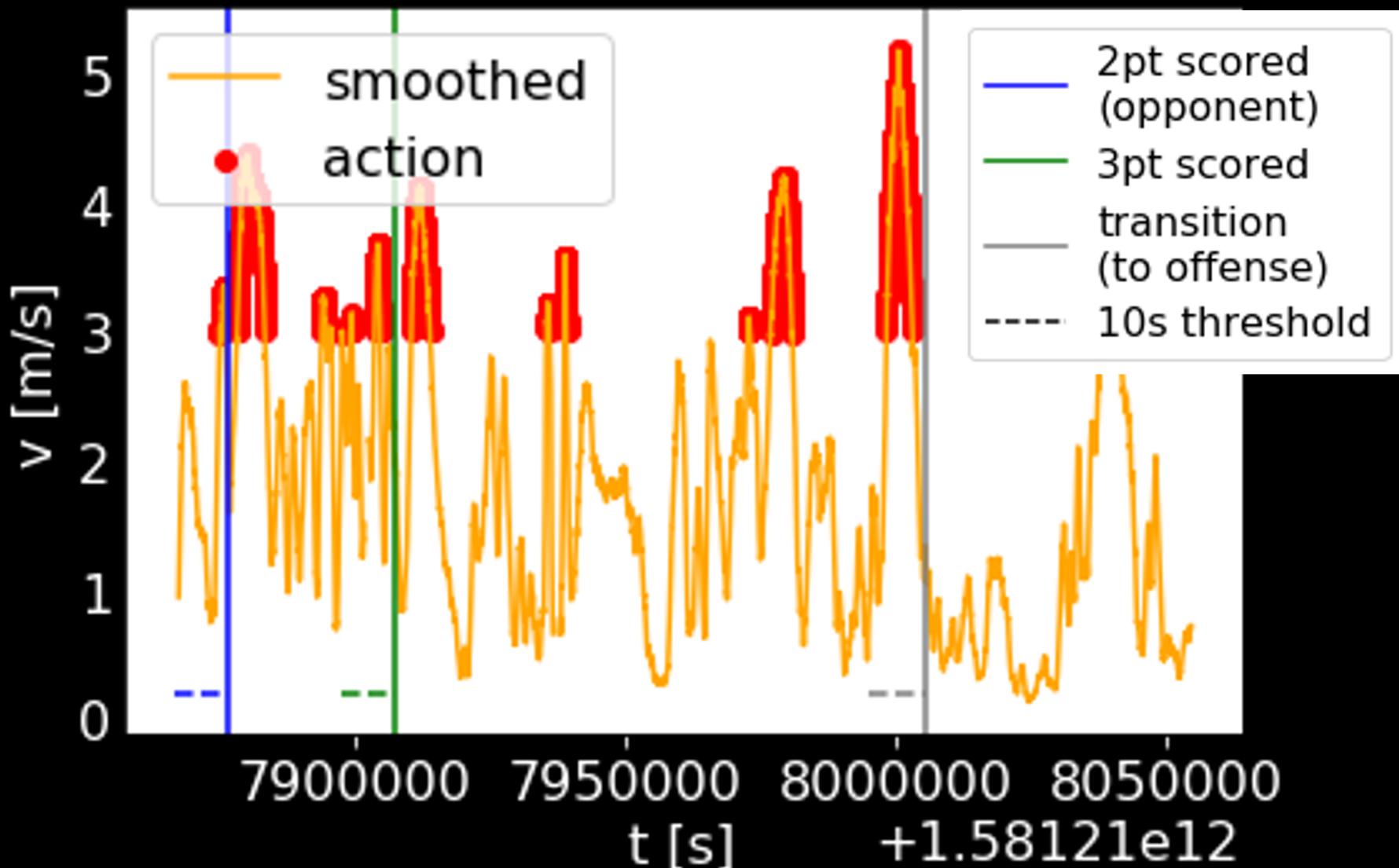


Extracting the off-the-ball action

3. Detect action
($v > 3$ for > 1 second, > 0.5 meter from the ball)



Quantifying the significance of the action



Quantifying the significance of the action

If we see major event within 10s of the action start,
we add score:

(e.g.)

3PT in: +3

2PT in: +2

(Opponent) Foul: +1

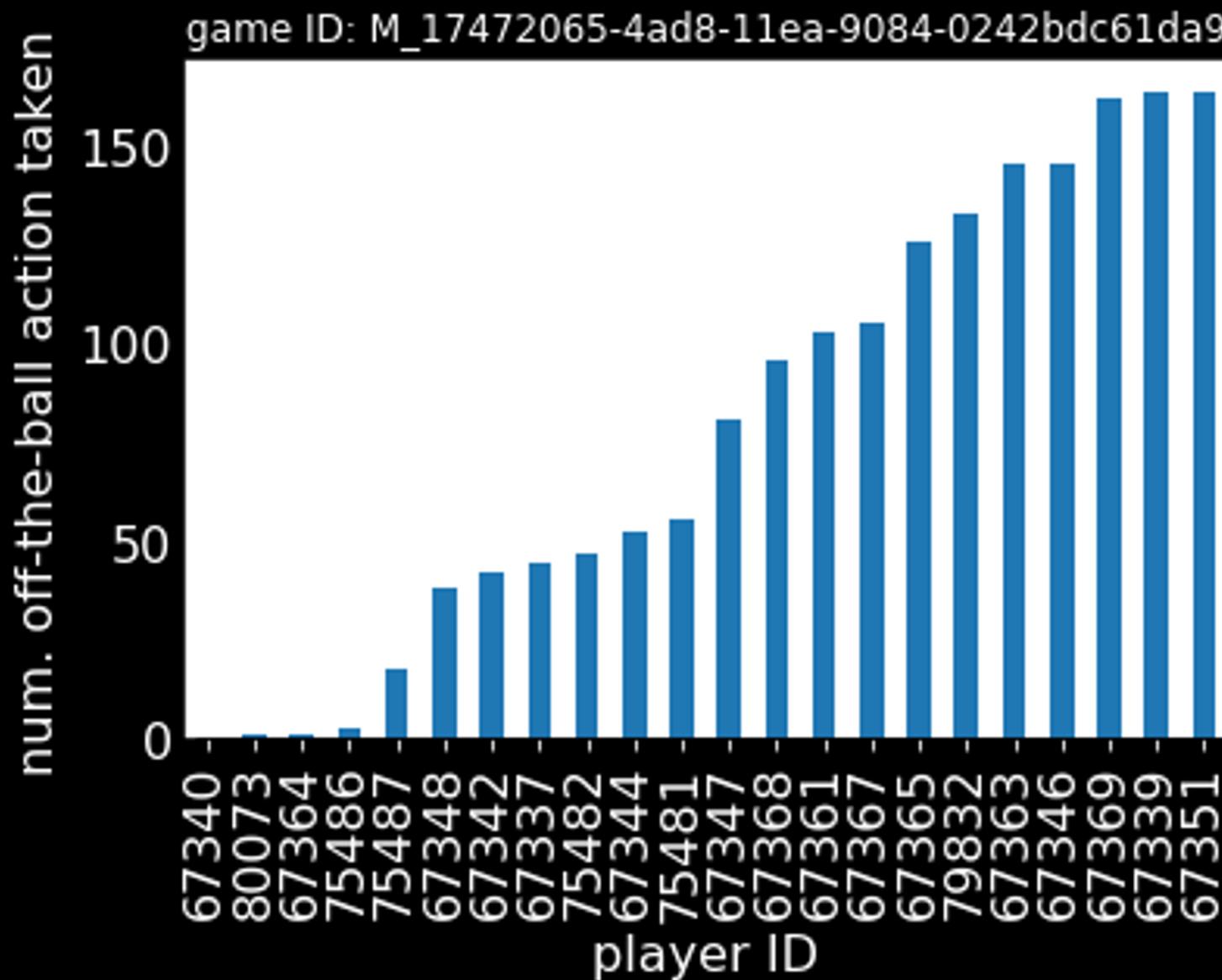
Offensive Rebound: +0.5

>6 passes: +0.4

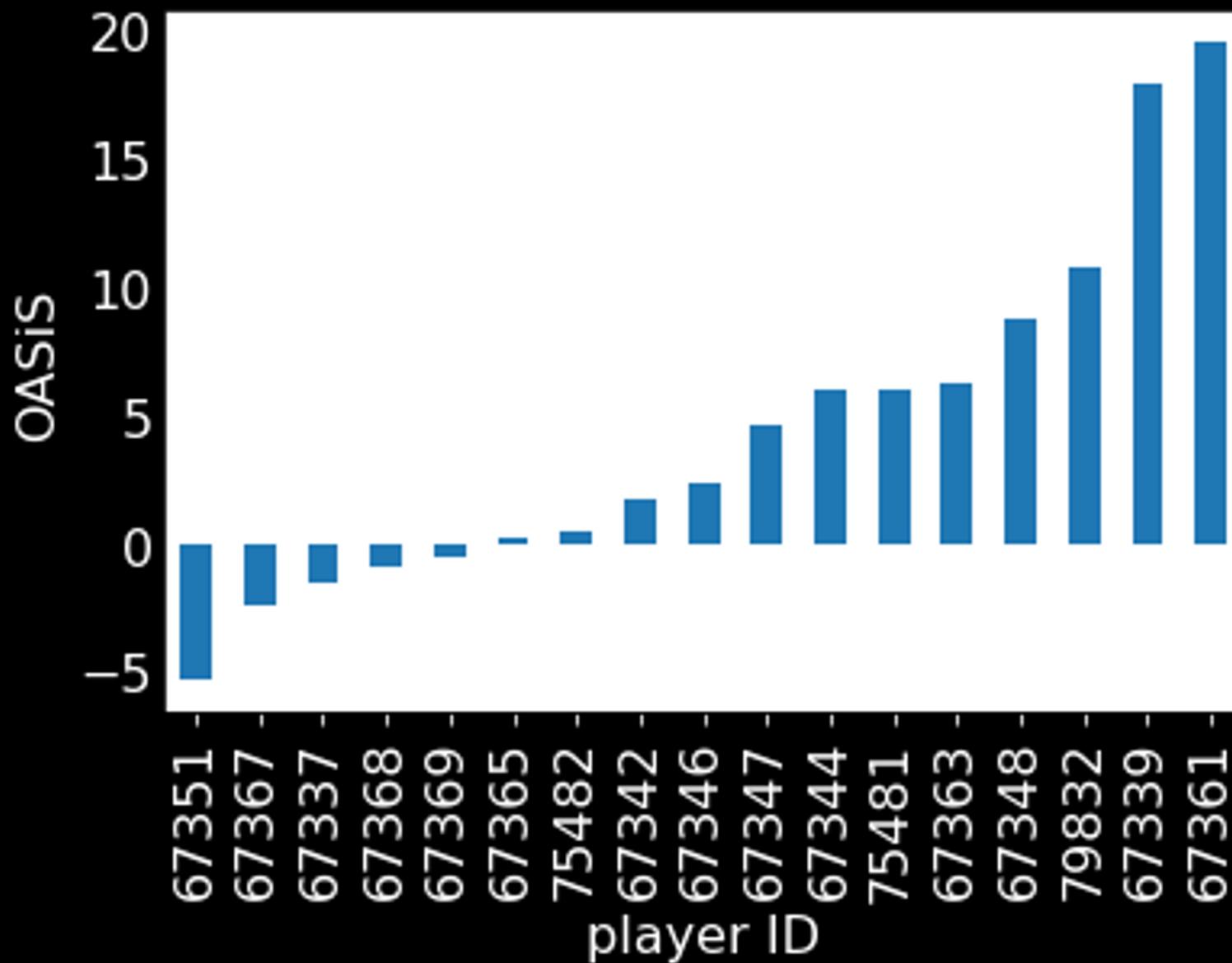
Turnover: -1

(Score signs flipped when it is opponent's action)

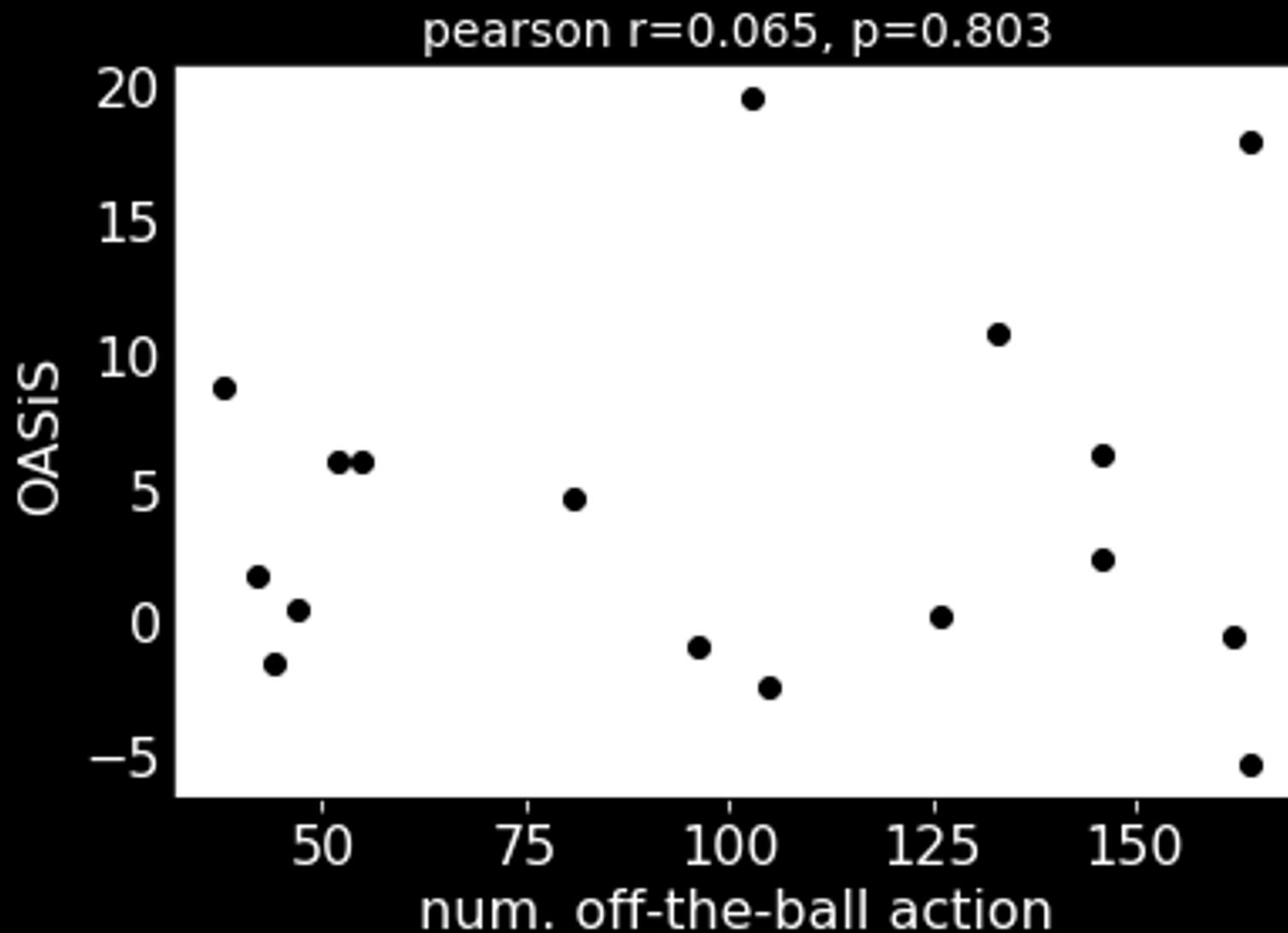
Number of action is quite different per players



Distribution of OASiS:

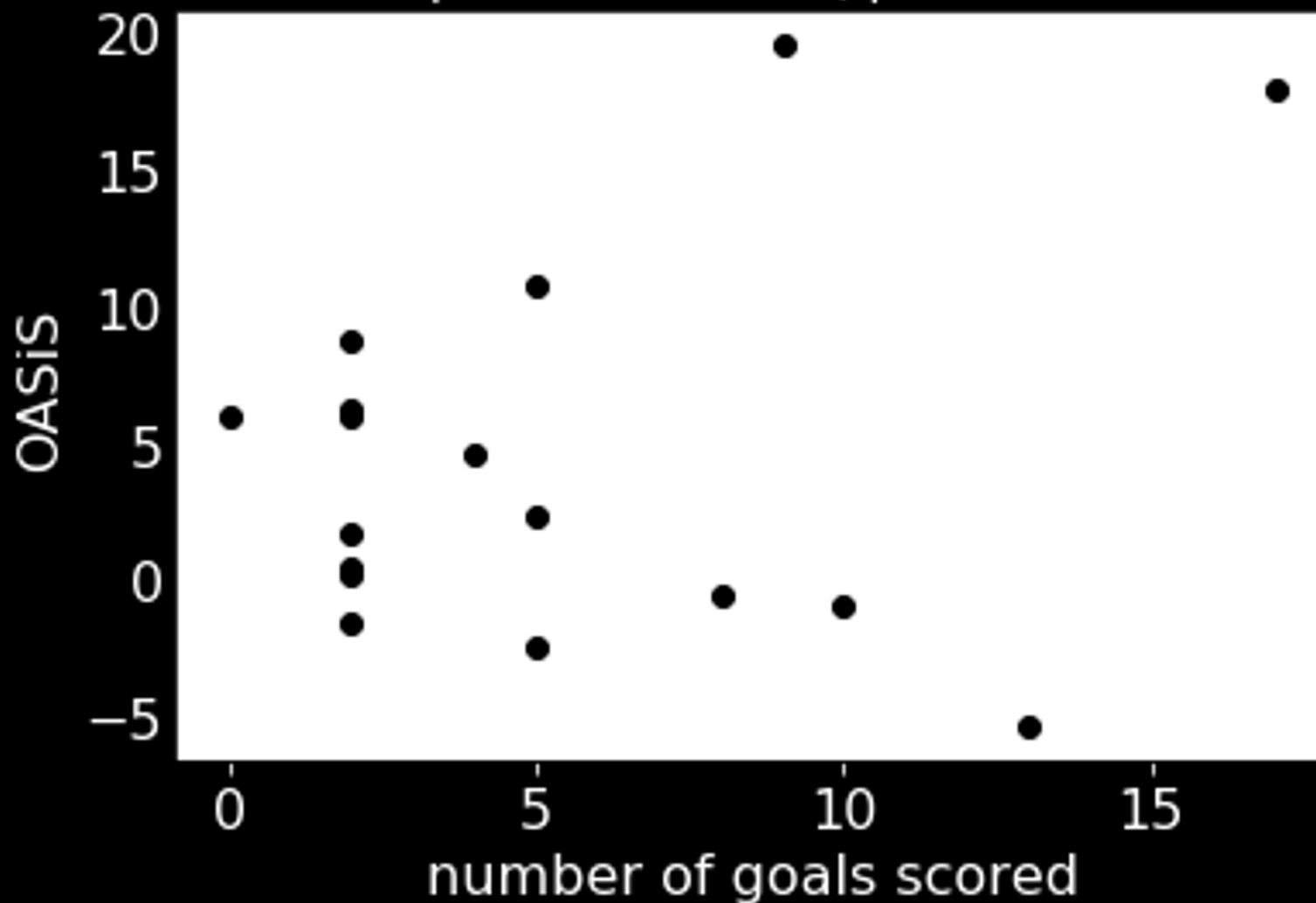


OASiS does not strongly correlate with the number of off-the-ball action itself



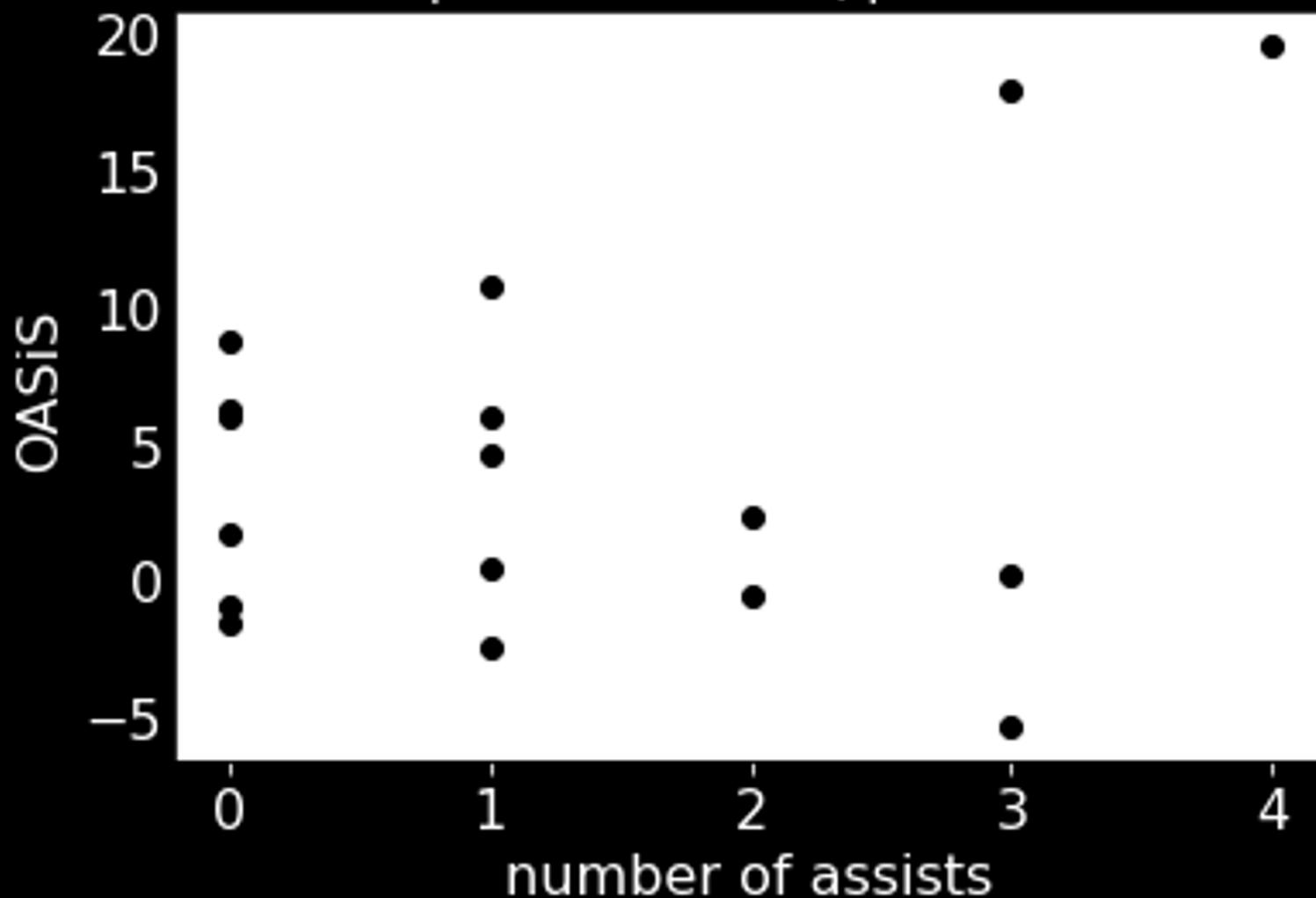
OASiS does not strongly correlate with goals or assists (= providing new metric)

pearson r=0.241, p=0.351



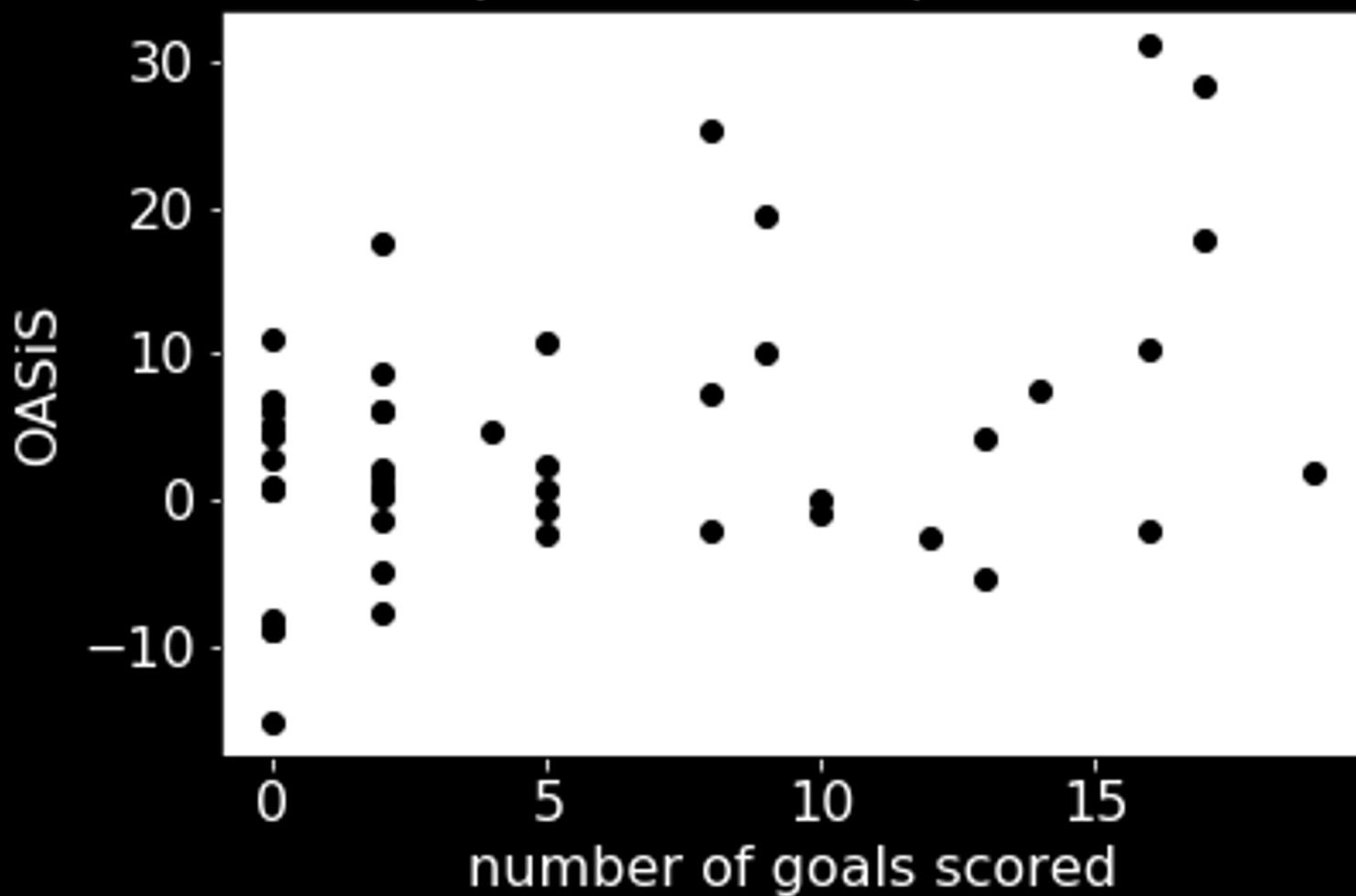
OASiS does not strongly correlate with goals or assists (= providing new metric)

pearson r=0.306, p=0.231



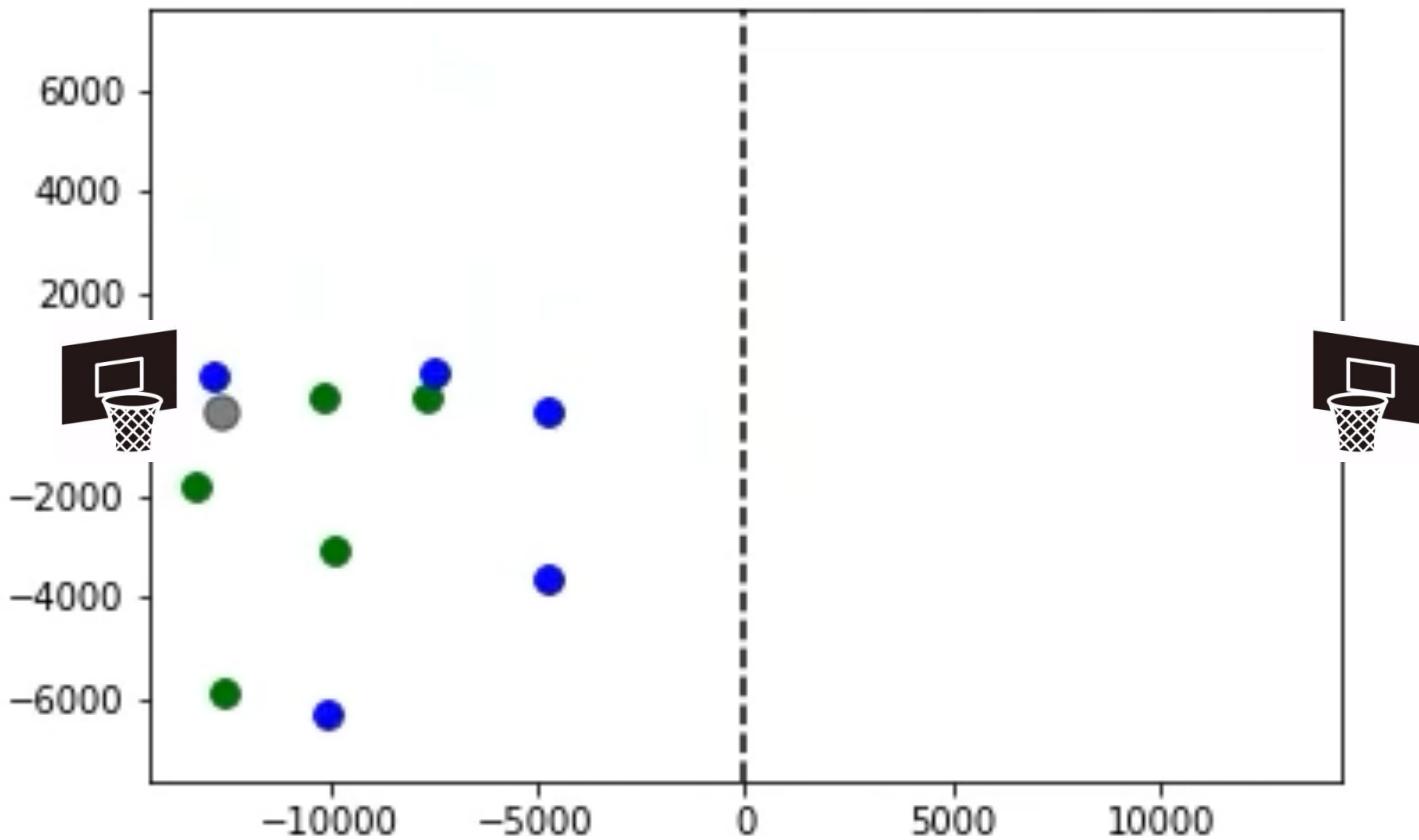
OASiS does not strongly correlate with goals or assists (weakly, with more sample size)

10 games, 49 unique players
pearson $r=0.406$, $p=0.003$



Visualizing an significant off-the-ball movement

(Movie available at [github](#))



Future work 1. More visualization

- Auto-crop and visualize off-the-ball actions and their consequences
- On-the-screen annotation in TV highlights
- Learn what kind of actions are effective

Future work 2. Algorithm

- Different scores for different consequences (e.g. action specifically useful for 3pt shot)
- More classification of the actions (e.g. directions / angles / distance from the ball / offensive or defensive) / parameter tuning
- Predictive model (“Will this players movement be effective?”)

Future work 3. Beyond basketball

- Any sports with 1 ball and many players
- E.g. Soccer



I find it terrible when talents are rejected on computer stats. My qualities, technique & vision, are not detectable by computer.

BBC SPORT

(quote, again by johan cruyff)

Thank you for your
(off-the-stage) participation

Twitter: @qbw_128

Code available at github
https://github.com/QingboWang/ssac_2020_oasis