

Space: The Final Frontier

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~~Space: The Final Frontier~~

Semi-Practical Player Ghosting

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Event Data

~ **2 Thousand** events logged per game

Only “on-the-ball” events logged

Highly detailed

Widely available

Relatively cheap

Tracking Data

~ **3 Million** measurements per game

All player positions recorded

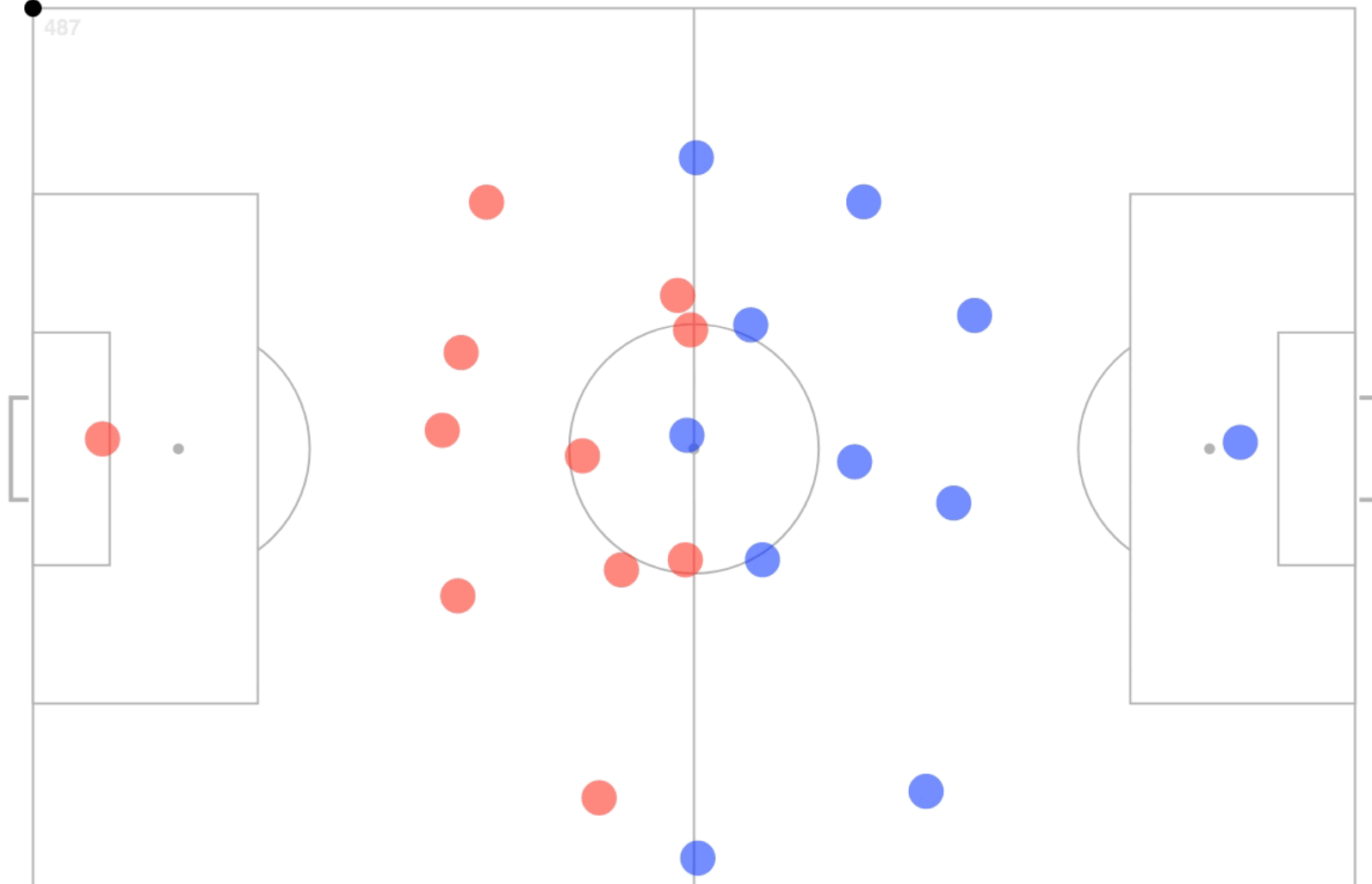
Have to build your own definitions

Available only to clubs (mostly)

Expensive



487



“

When you play a match, it is statistically proven that players actually have the ball 3 minutes on average ... So, the most important thing is: what do you do during those 87 minutes when you do not have the ball. That is what determines whether you're a good player or not.

”

Johan Cruyff

“

well ...

When you play a match, it is ~~statistically proven~~ that players actually have the ball 3 minutes on average ... So, the most important thing is: what do you do during those 87 minutes when you do not have the ball. That is what determines whether you're a good player or not.

”

Johan Cruyff

Motivation:

Capture the underlying spatial dynamics of off-ball positioning.

Inspiration:

Image classification

Feature recognition

Style transfer

Some Similar + Related Work:

Classifying NBA Offensive Plays Using Neural Networks

Kuan-Chieh Wang, Richard Zemel

MIT SSAC 2016

Data-Driven Ghosting using Deep Imitation Learning

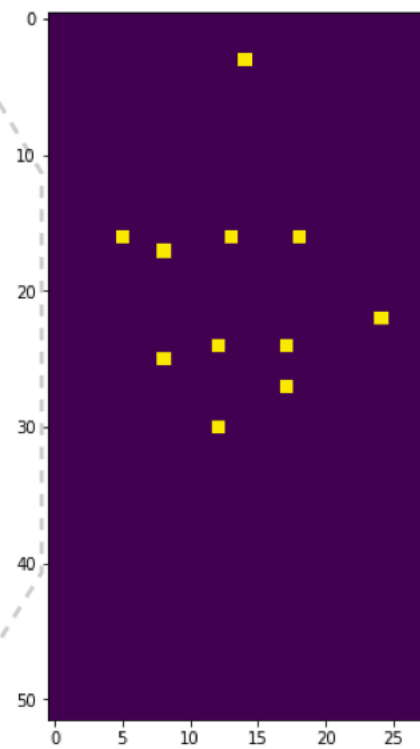
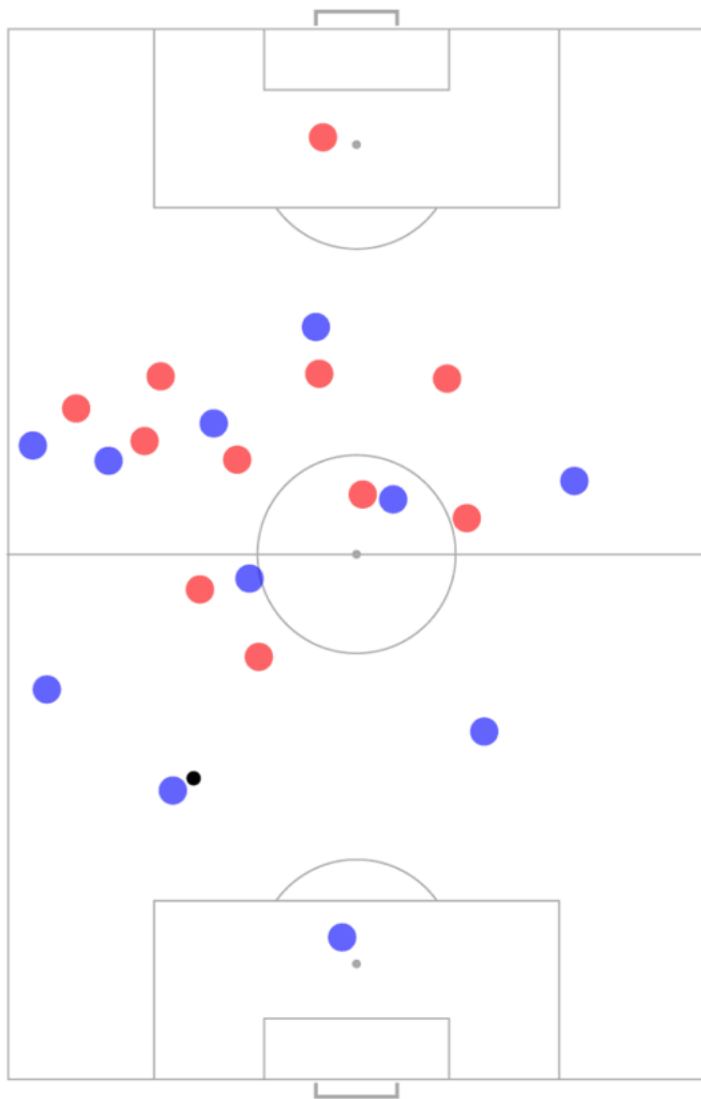
Hoang M. Le, Peter Carr, Yisong Yue, and Patrick Lucey

MIT SSAC 2017

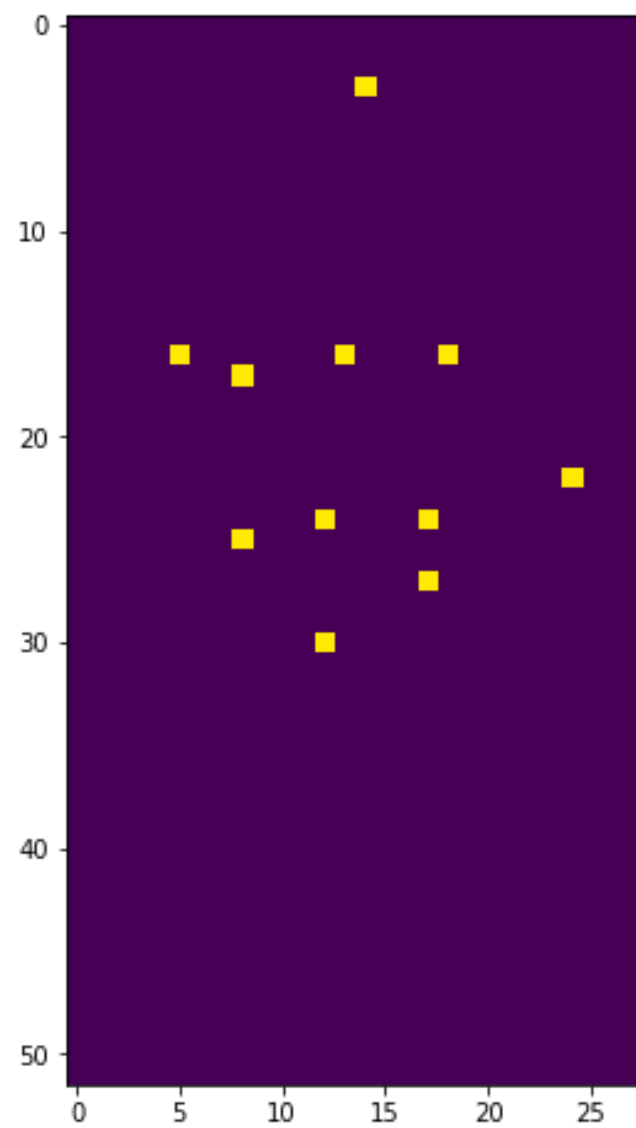
A Learned Representation for Artistic Style

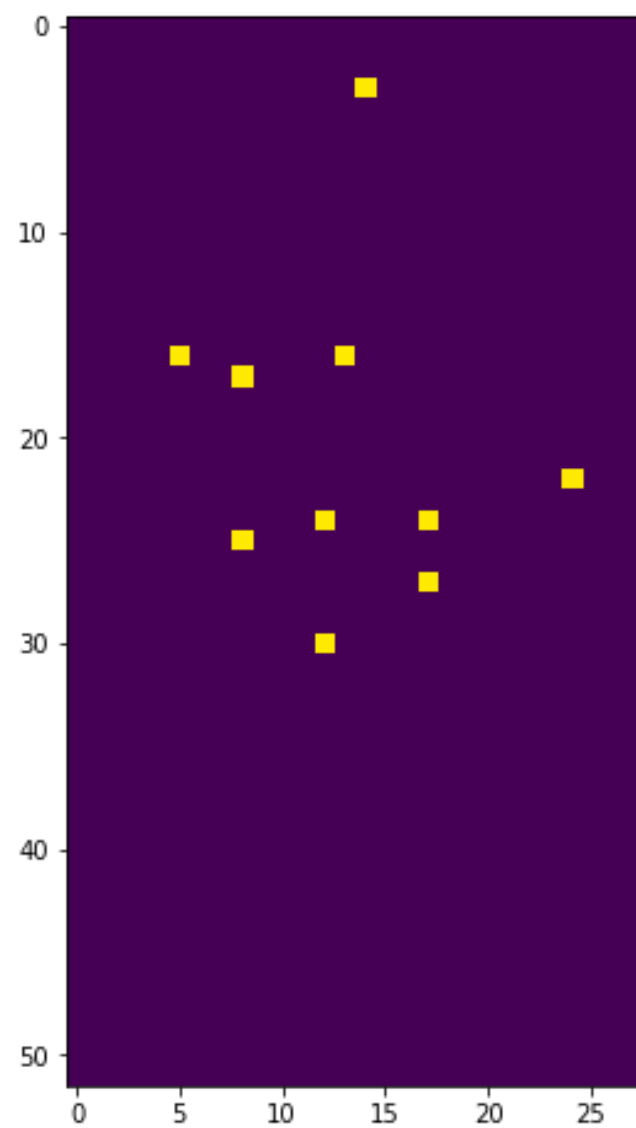
Vincent Dumoulin & Jonathon Shlens & Manjunath Kudlur

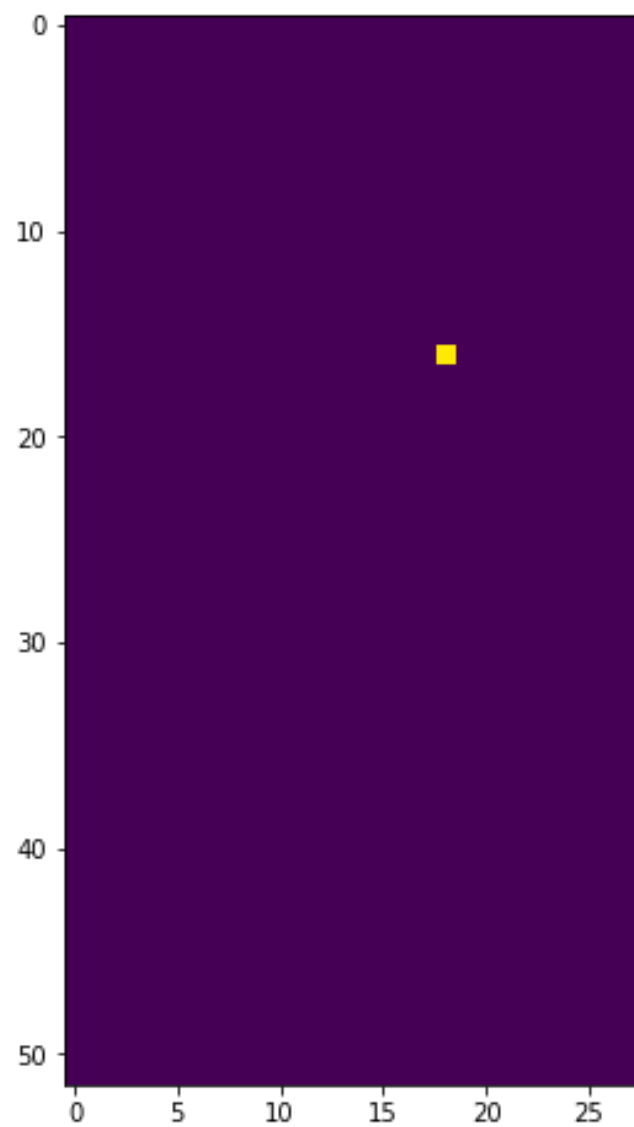
ICLR 2017

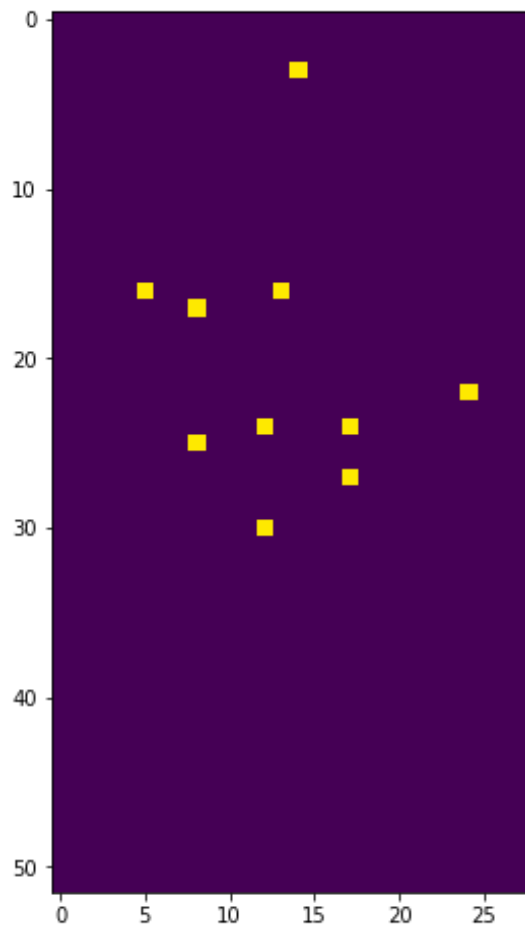


52x28x1

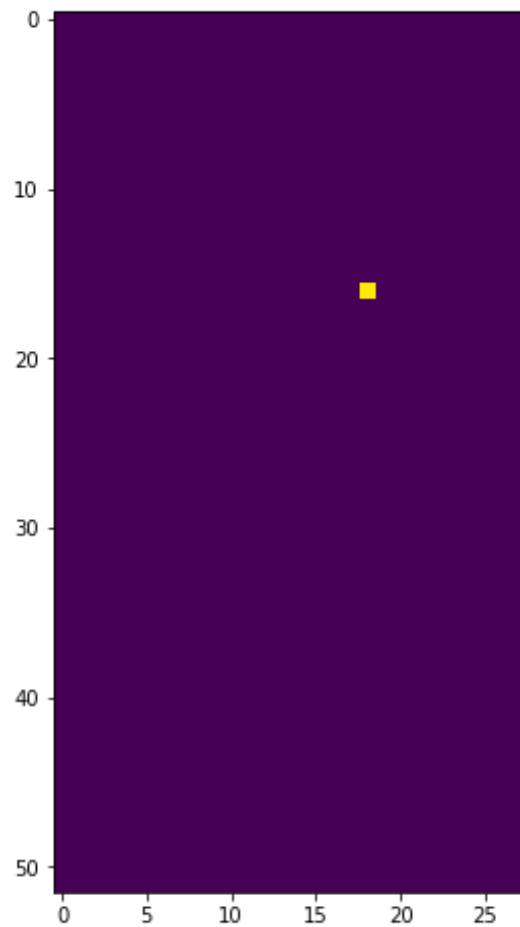




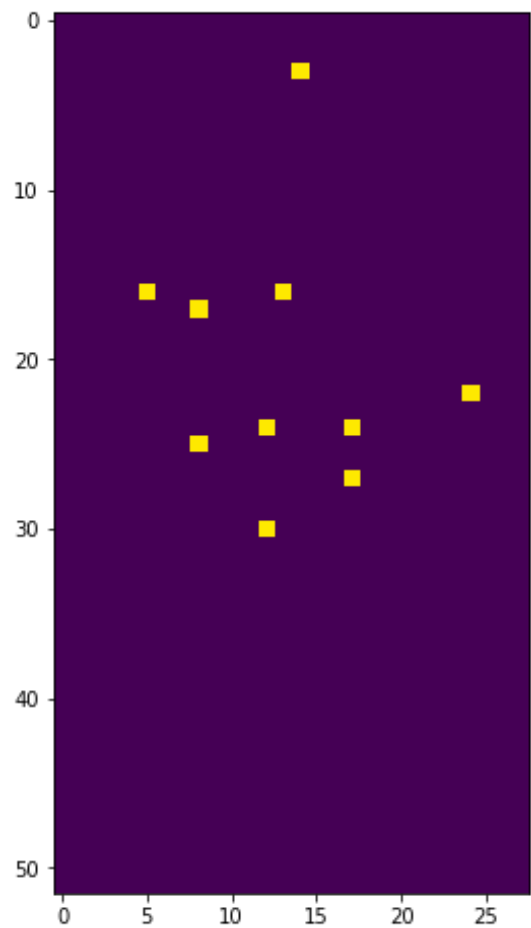




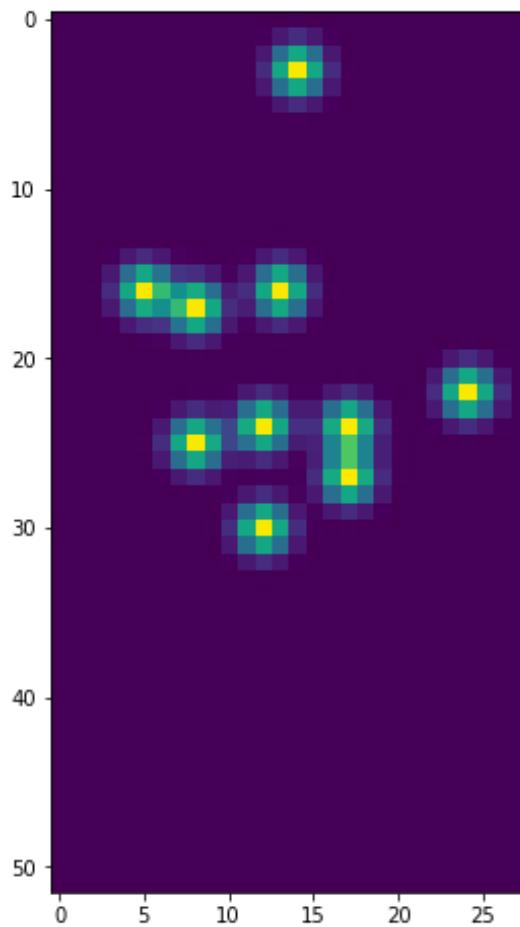
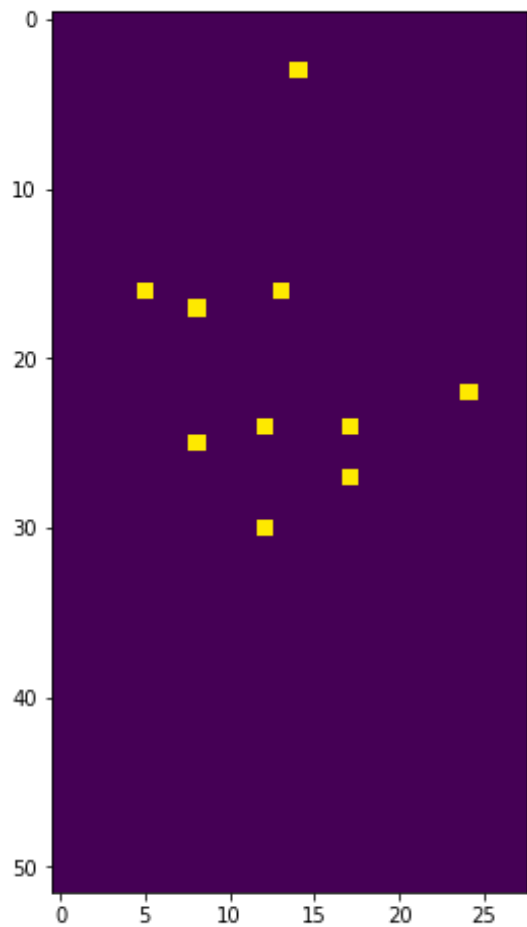
→ Magic! →



Data PreProcessing!

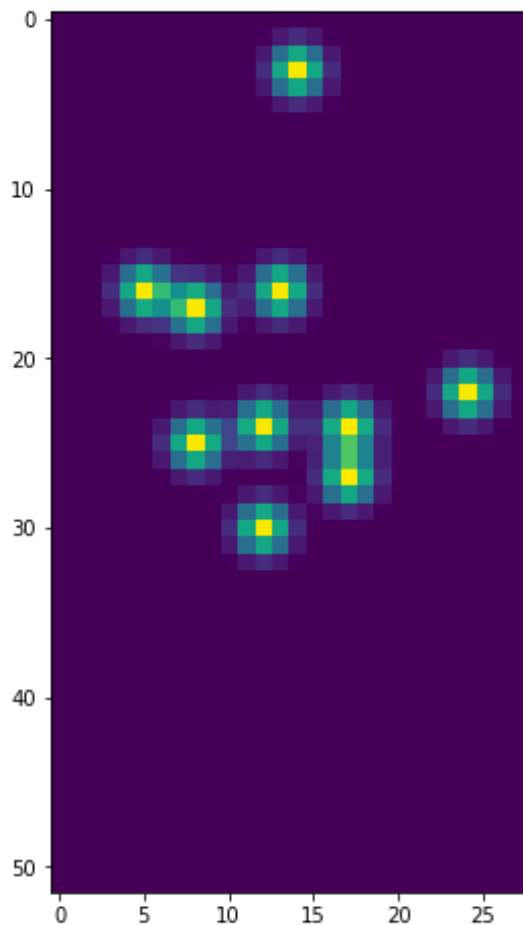
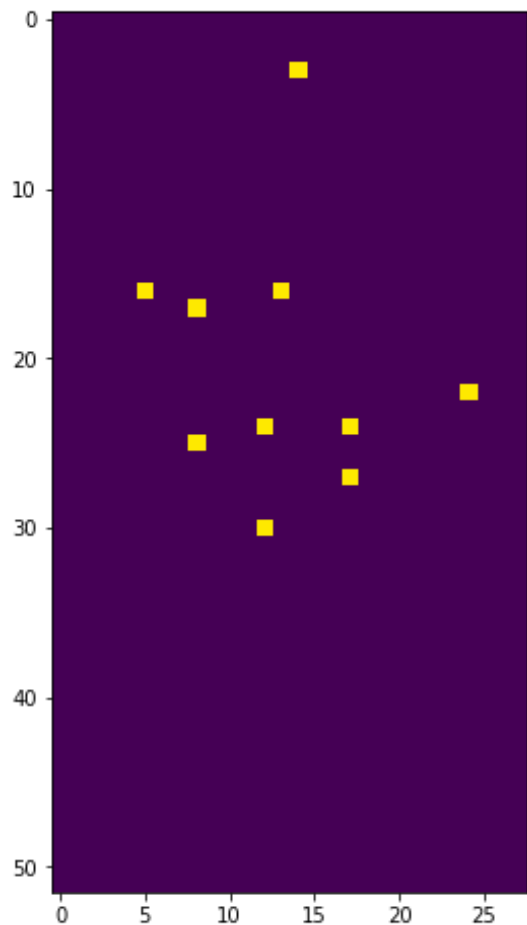


Data PreProcessing!

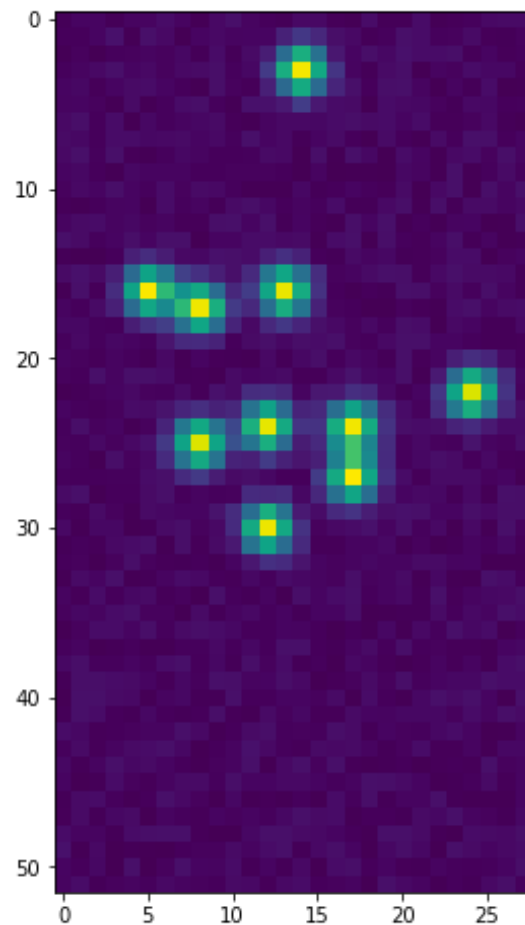


Gaussian Blur
 $\sigma = 1$

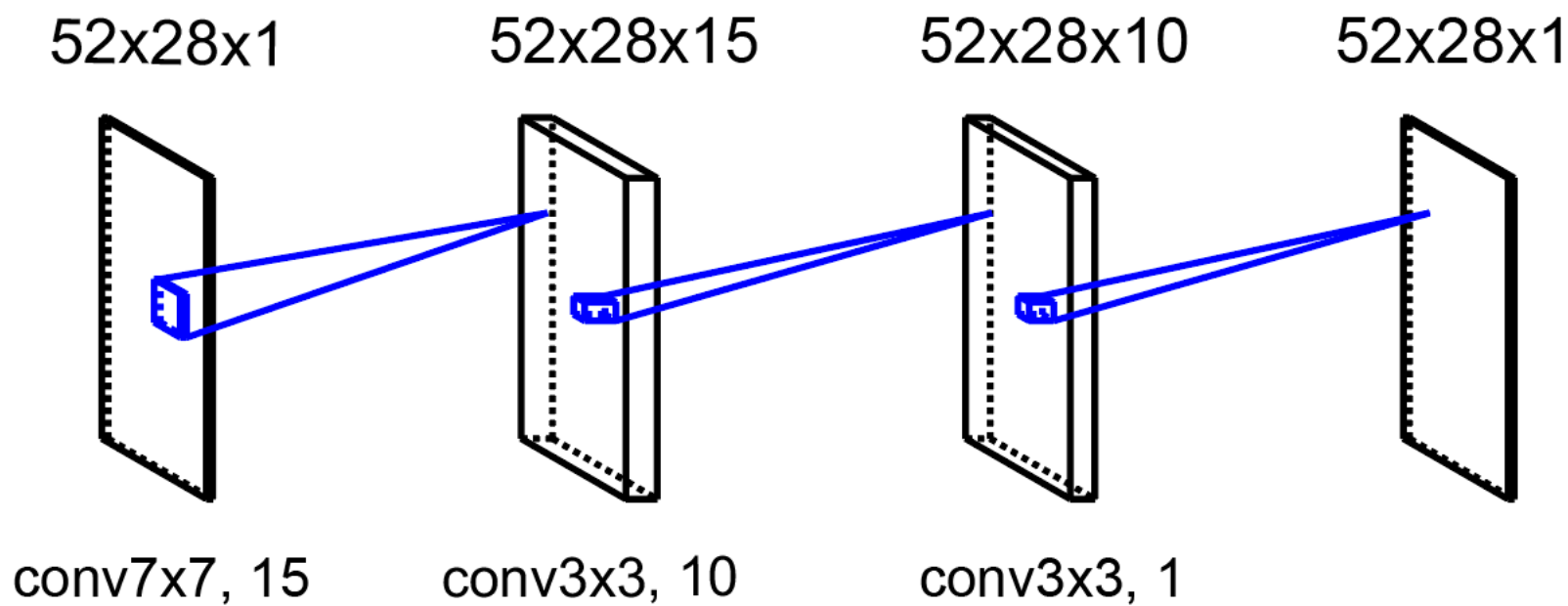
Data PreProcessing!



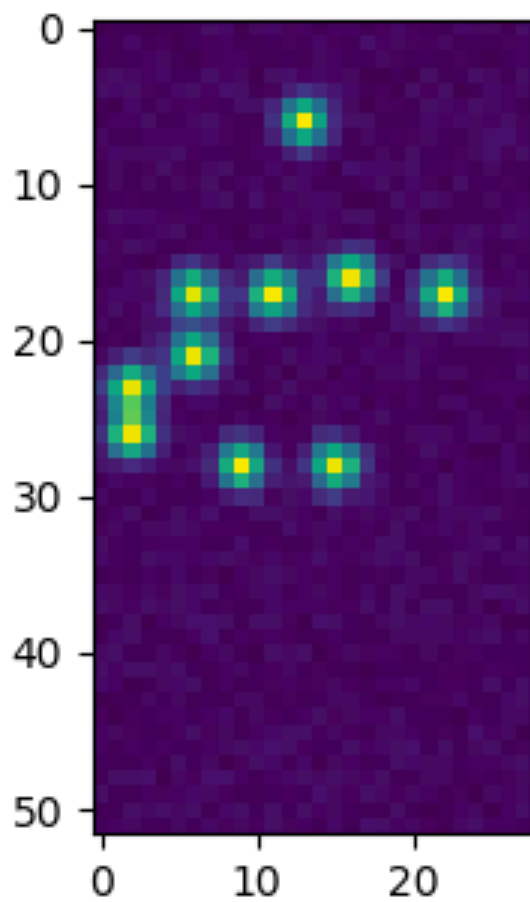
Gaussian Blur
 $\sigma = 1$



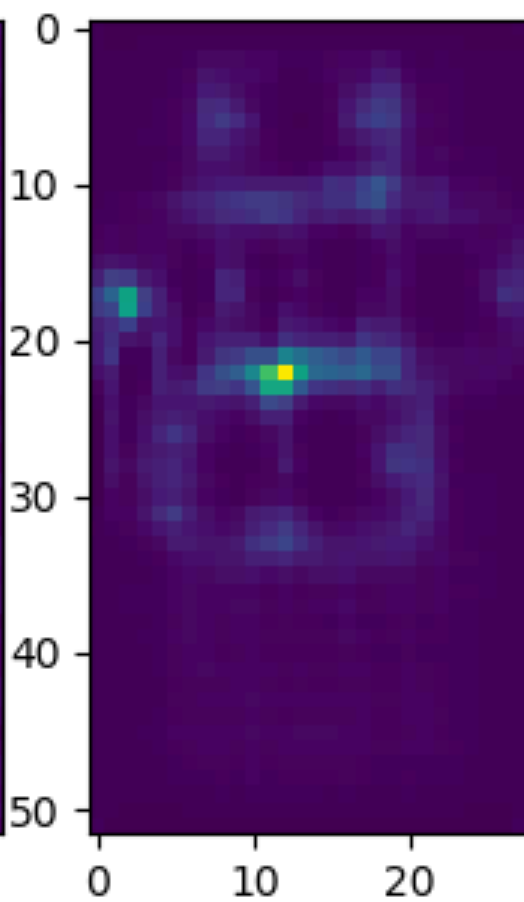
Add Noise (x5)



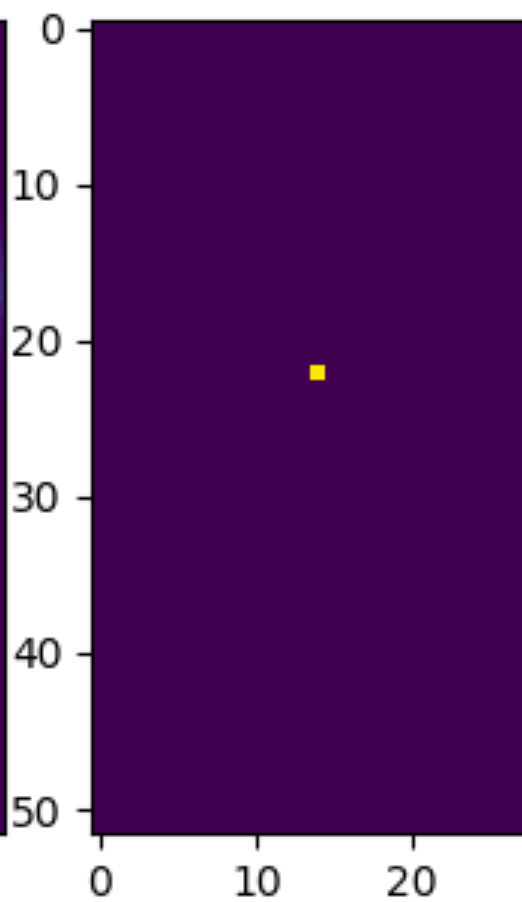
Input



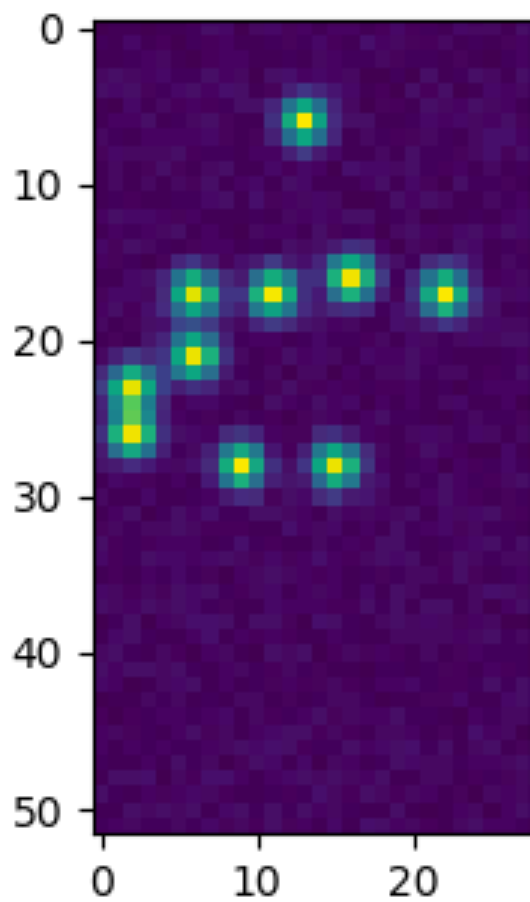
Prediction



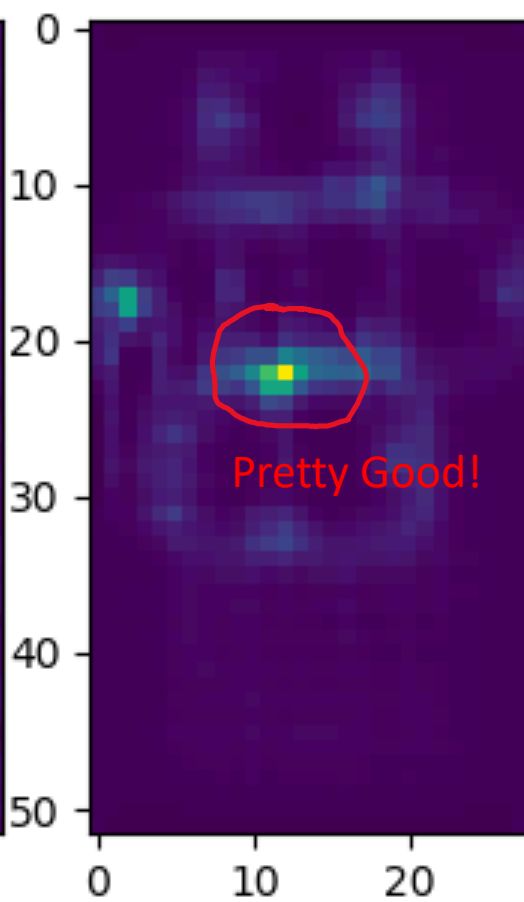
Truth



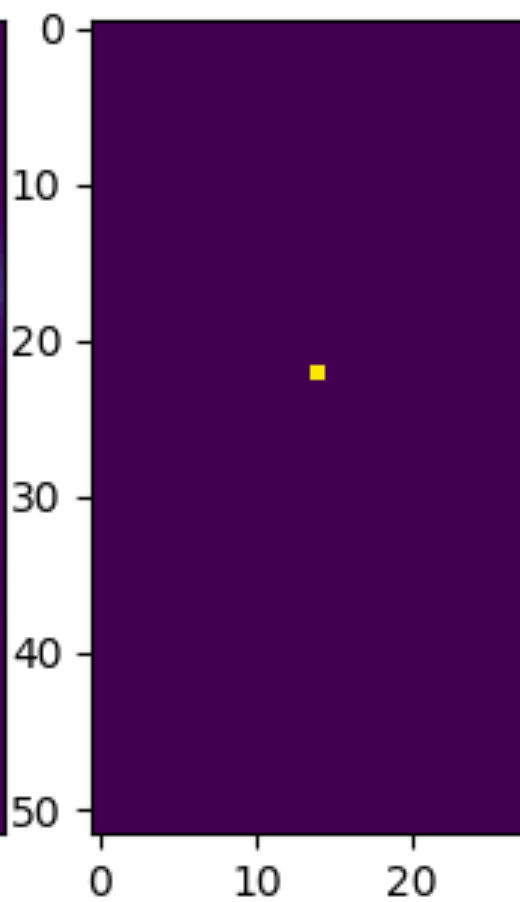
Input



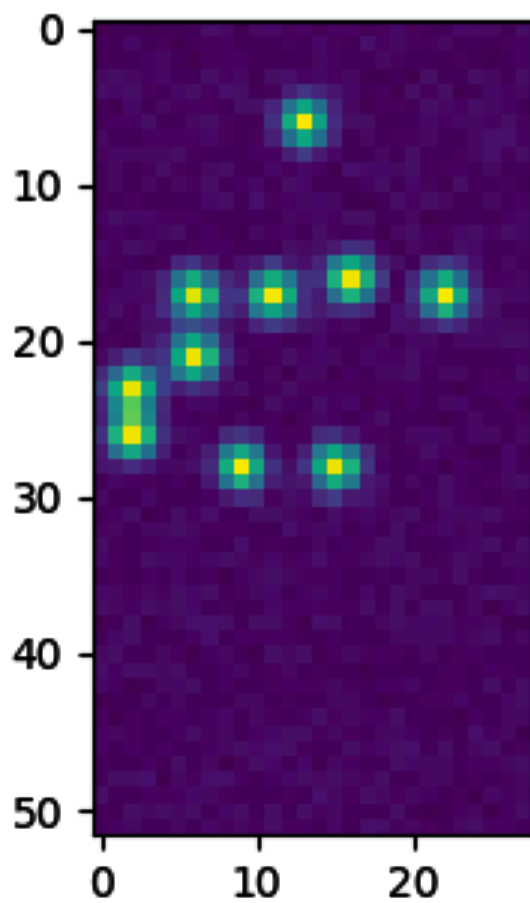
Prediction



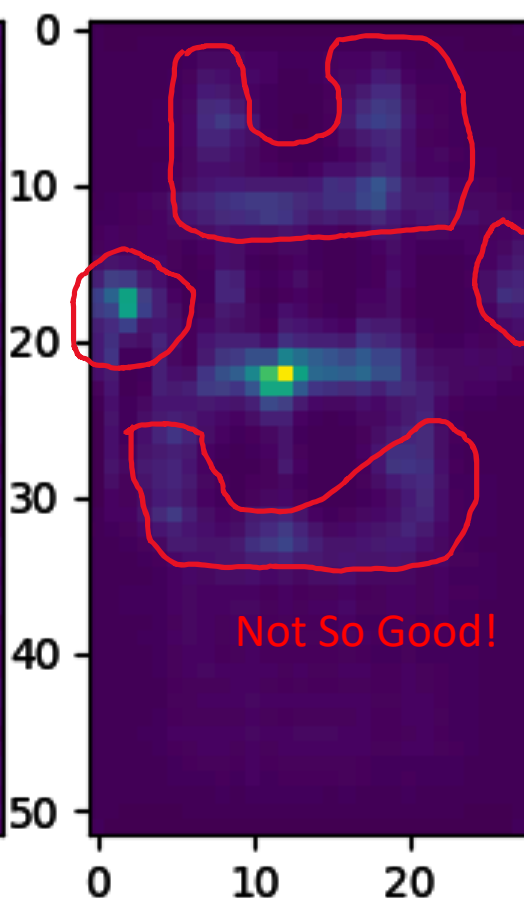
Truth



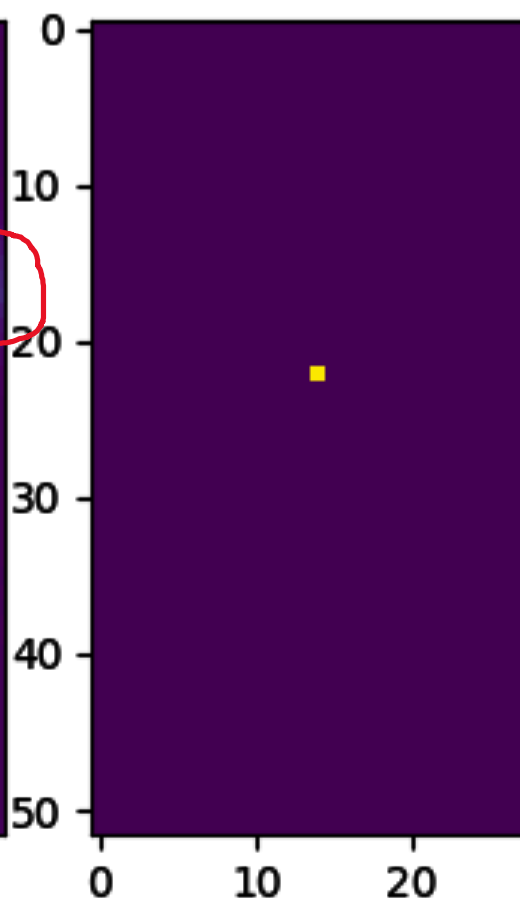
Input



Prediction



Truth



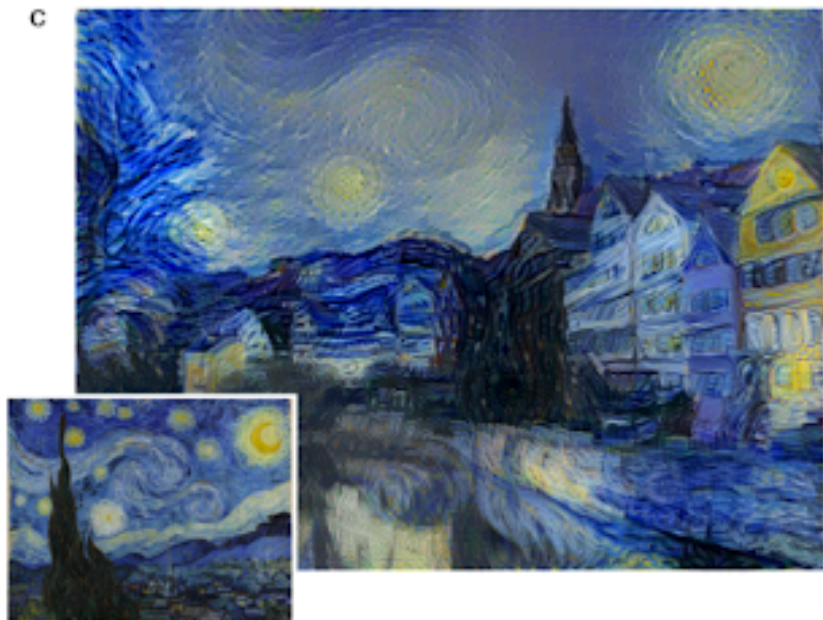
A



B

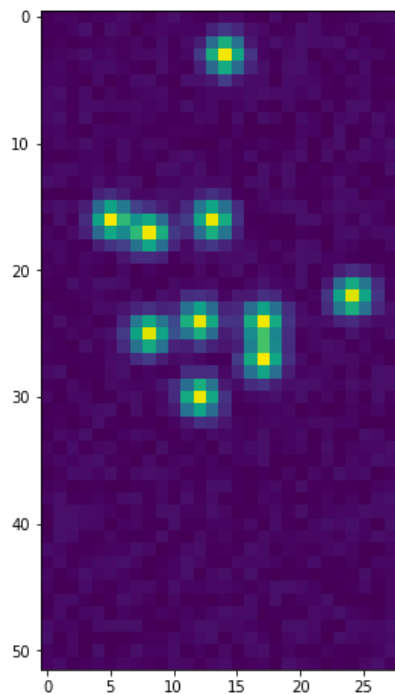


C



D



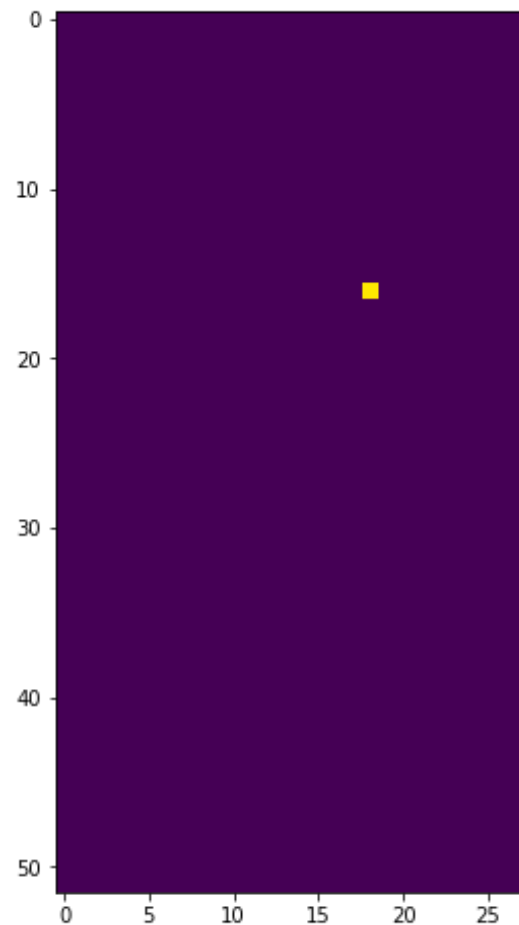


+

11x1
Player Identity
Vector
One-Hot Encoded



Magic!

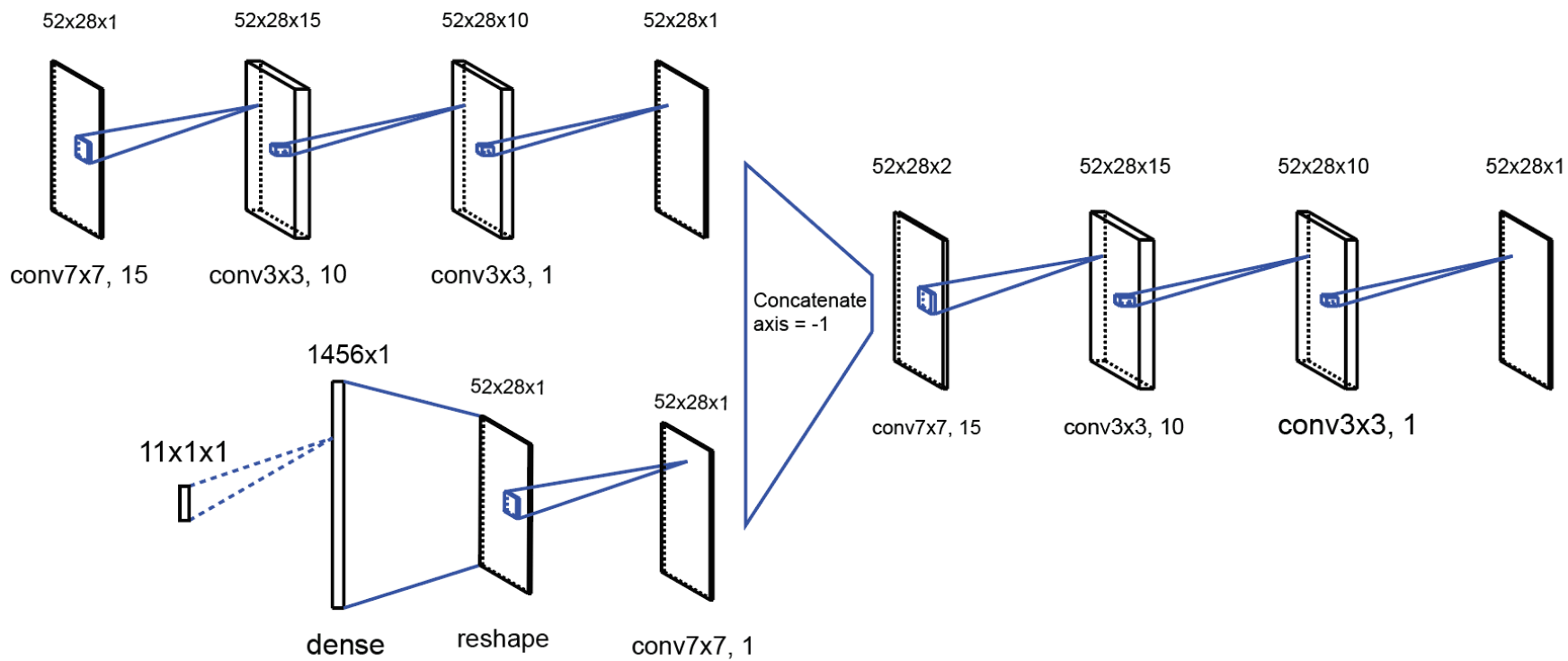


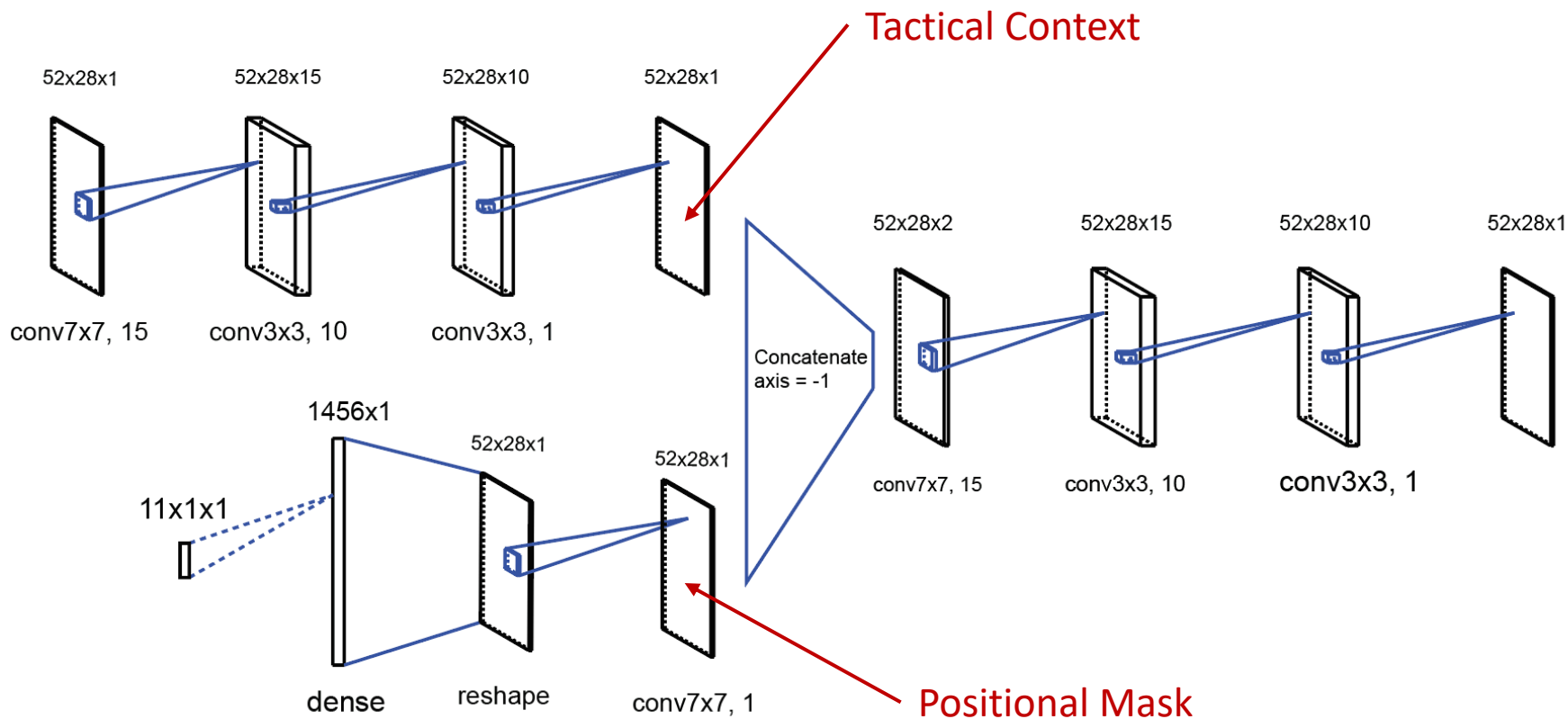
```
1 encodings[i]
```



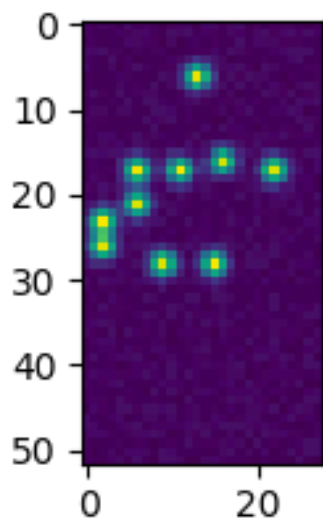
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Command took 0.01 seconds -- by dpleuler@torontofc.ca at 9/11/2019, 10:10:04 AM on  
tensorflow_single_node
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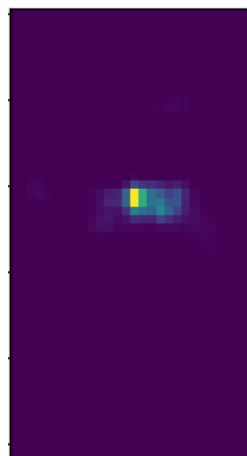





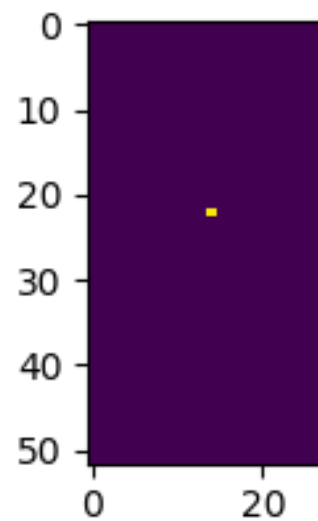
Input



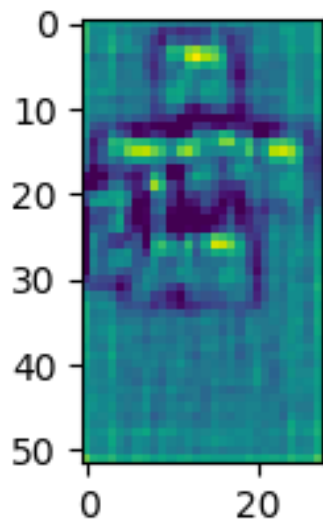
Prediction



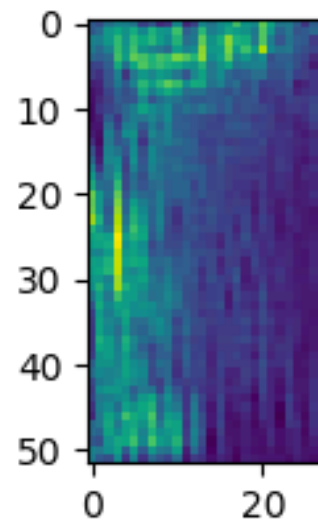
Truth



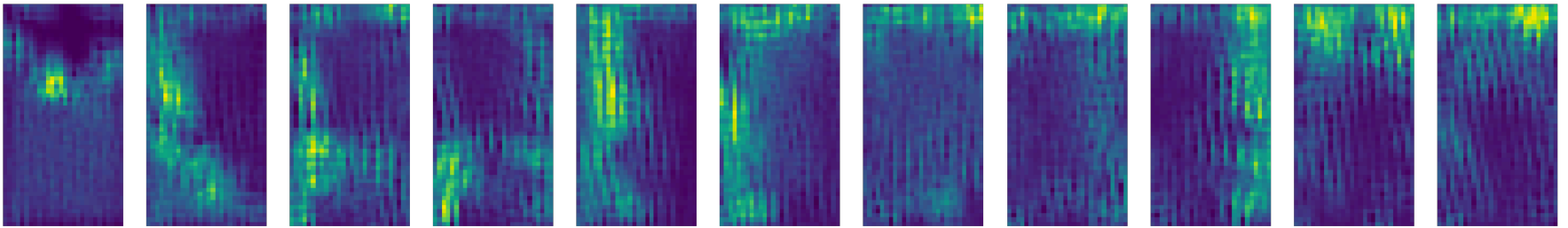
Tactical
Context



Positional
Mask



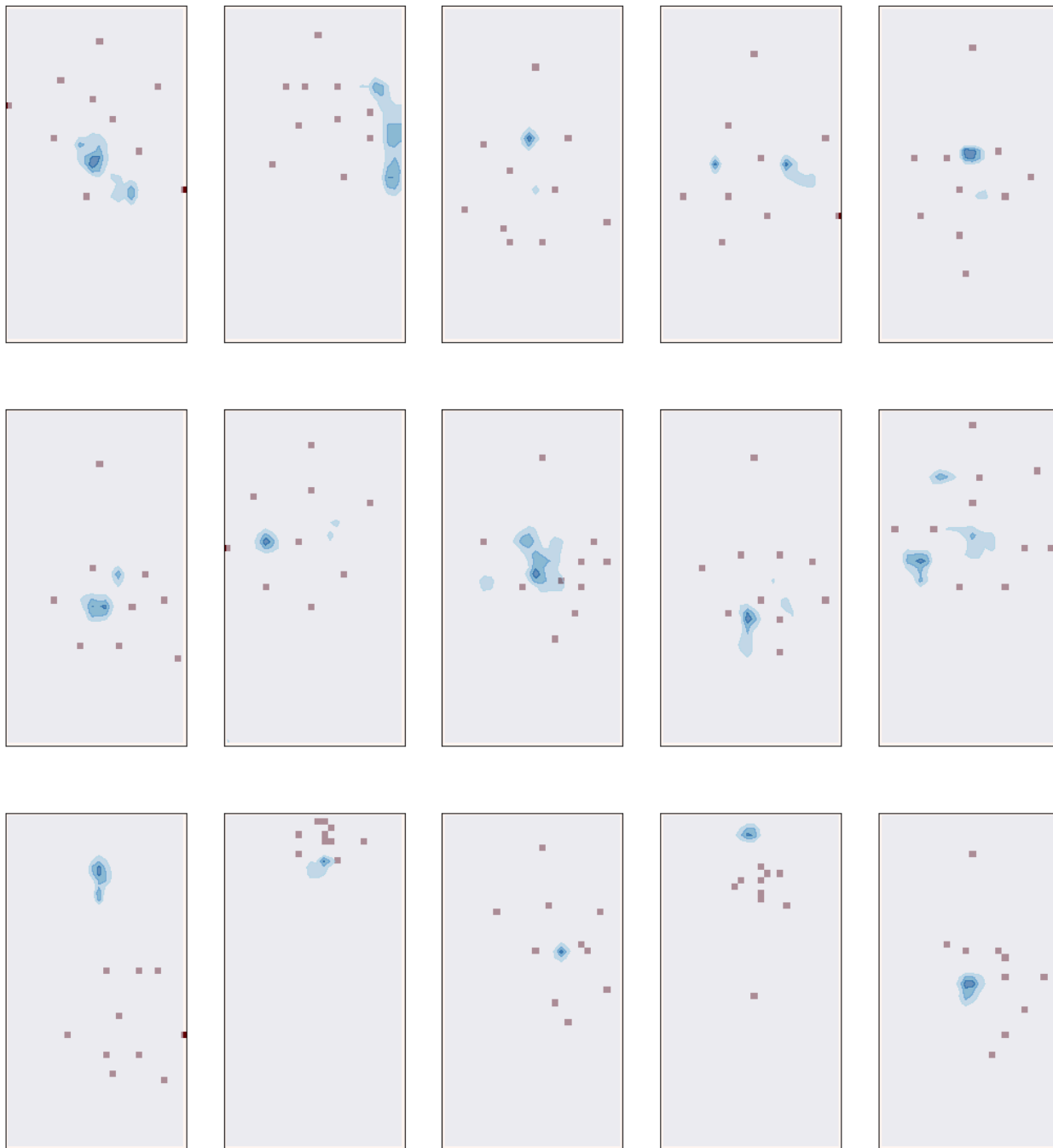
Positional Masks:



Predictions:



Predictions:

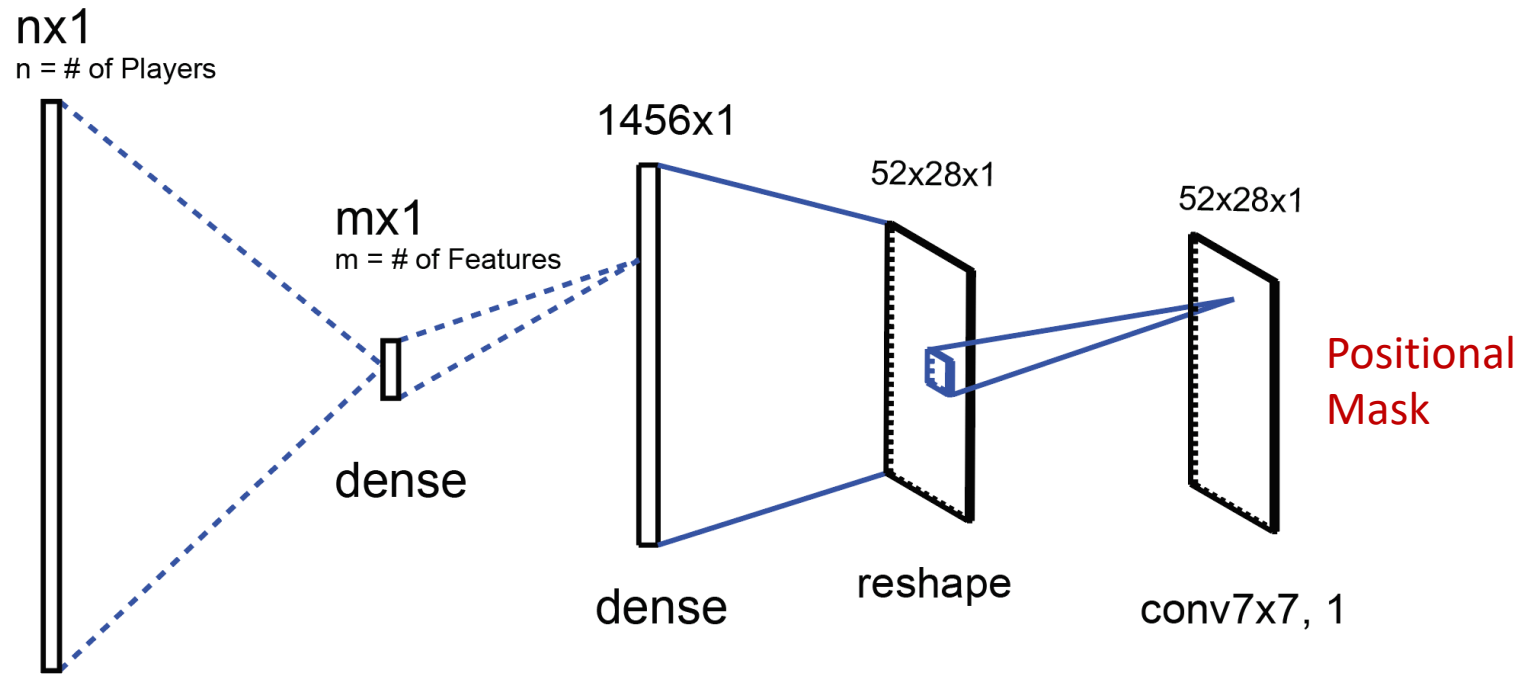


Predictions:

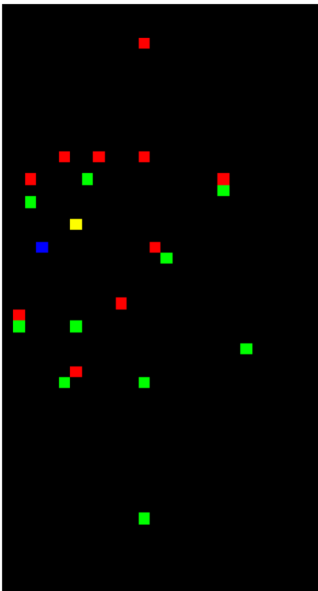


Next Steps:

Player-Specific Encodings!

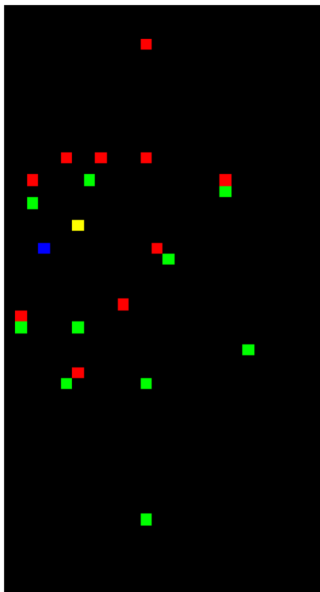


Other Ideas:

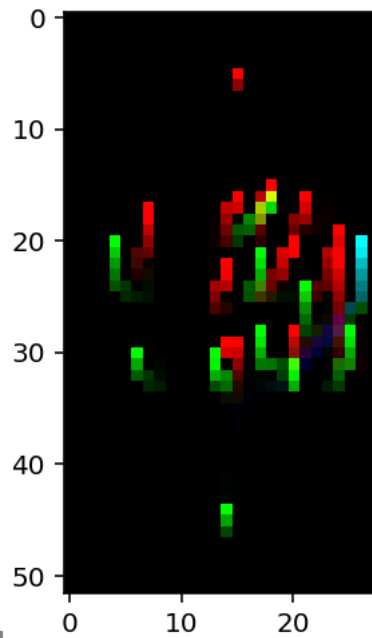


Include Opposition + Ball
(RGB Image)

Other Ideas:

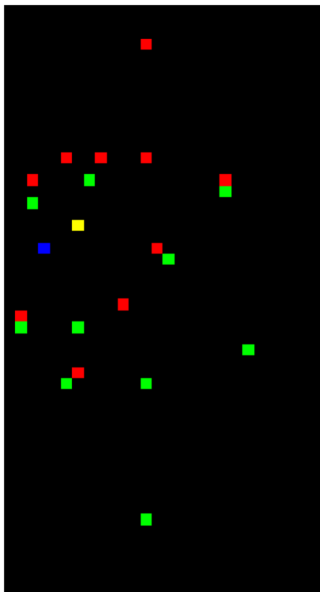


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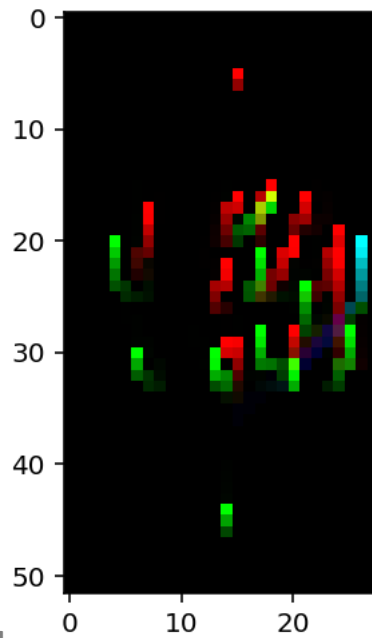


Player Trails

Other Ideas:



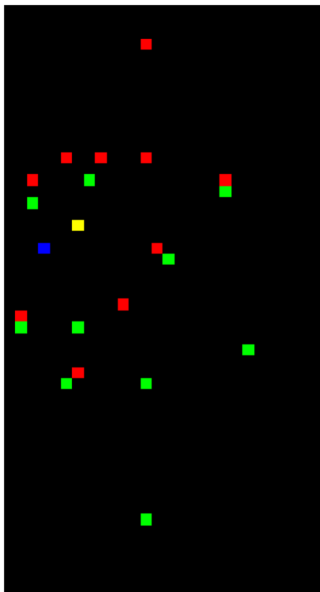
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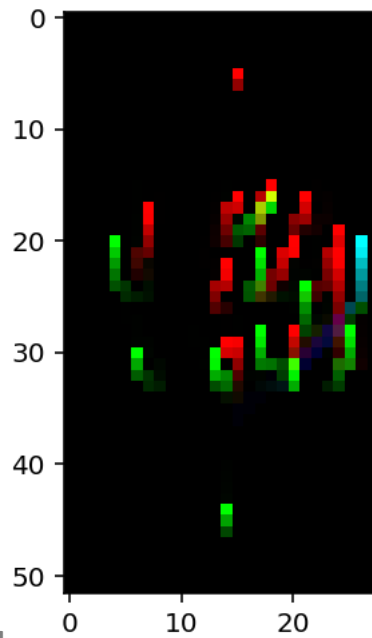
Player Trails

LSTM
Architecture

Other Ideas:



Include Opposition + Ball
(RGB Image)



Player Trails

LSTM
Architecture

Autoencoder

Thanks!

Also to:

Rafit Jamil

TFC Analytics Intern + Waterloo University

Erika Munoz

MLSE Data Scientist



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