

Continuous space models

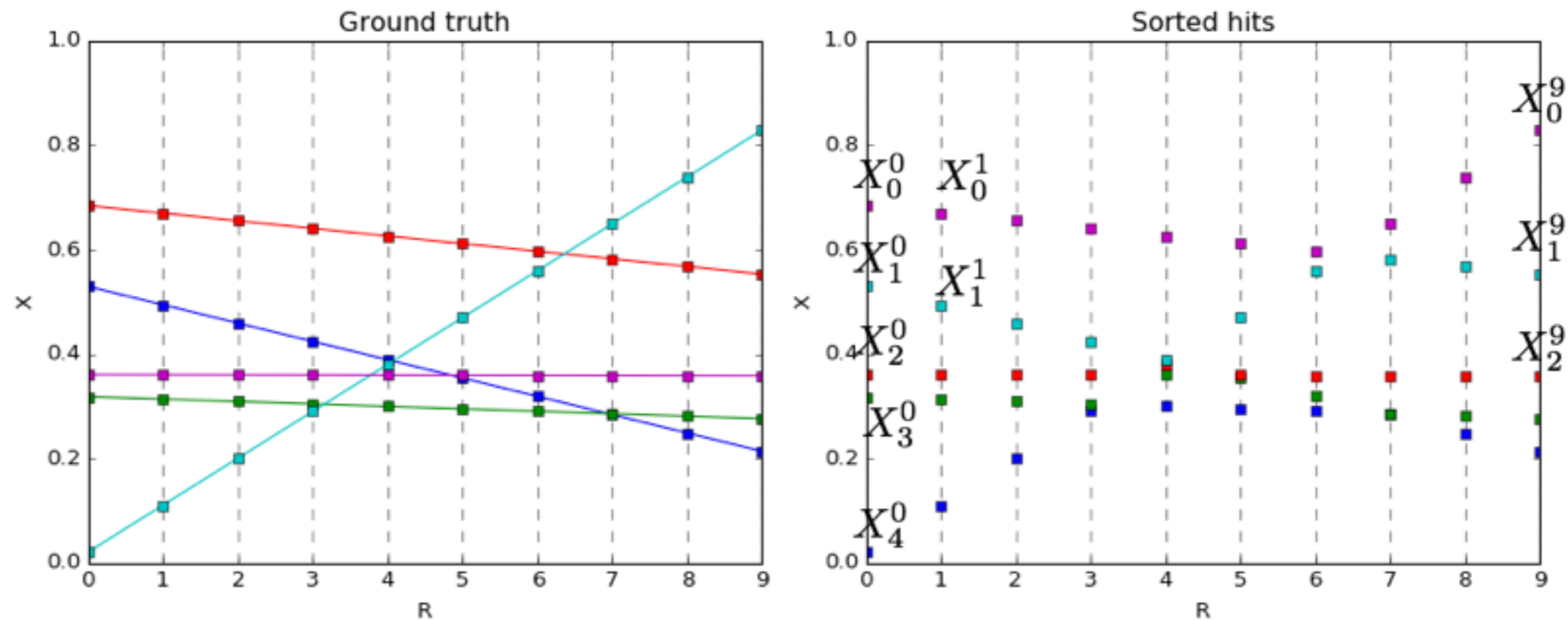
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HEP.TrkX Meeting

Introduction

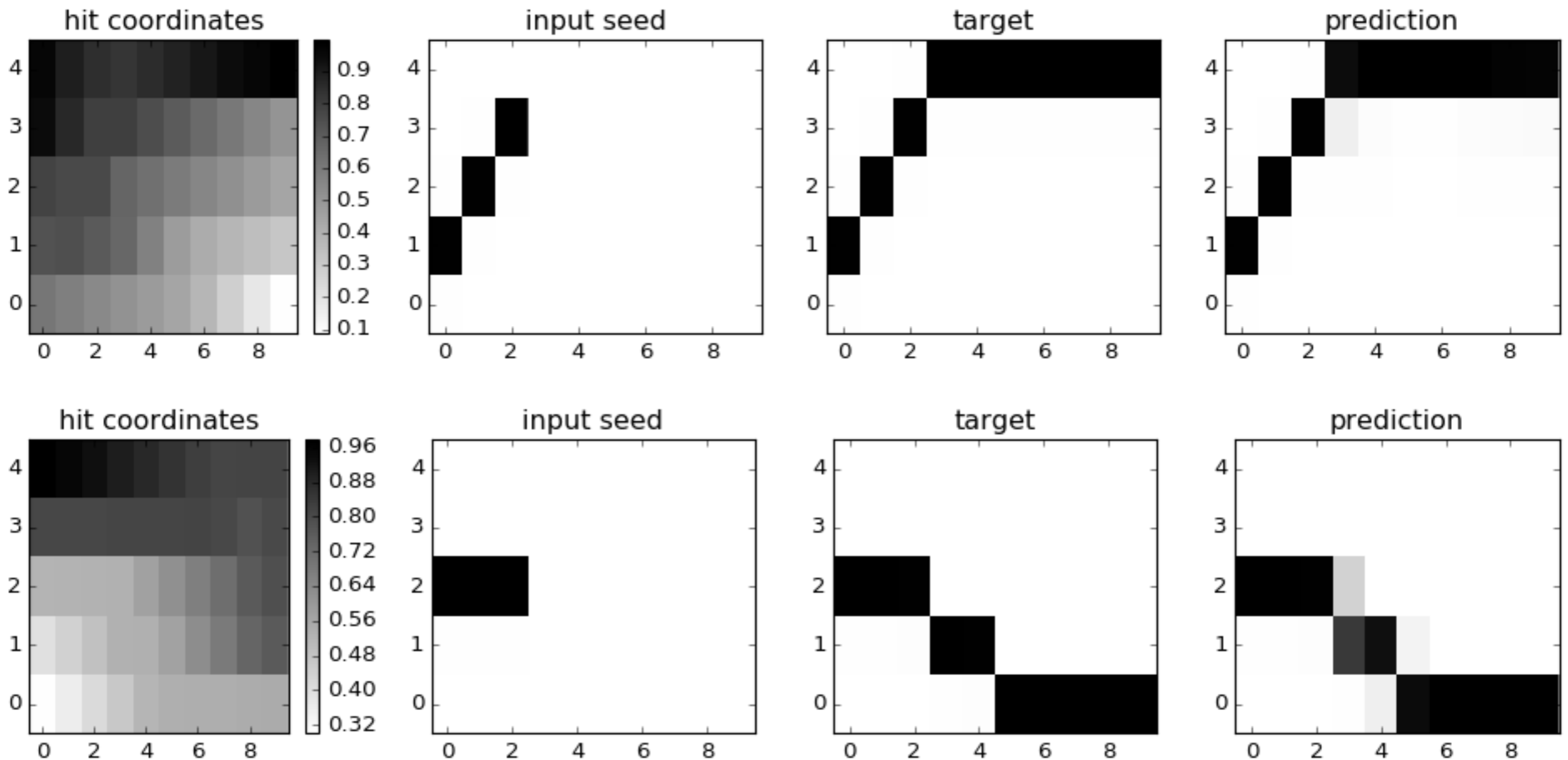
- Discrete space ideas have been fun, but they'll face big challenges
 - Hard to construct good “images”
 - High dimensionality + sparsity
- I want to explore some ideas on continuous space data
 - different from the seq2seq approach of JR+Dustin
 - using the clustered pixel hits
 - some ideas may carry over from pervious work

Continuous space hit classifier



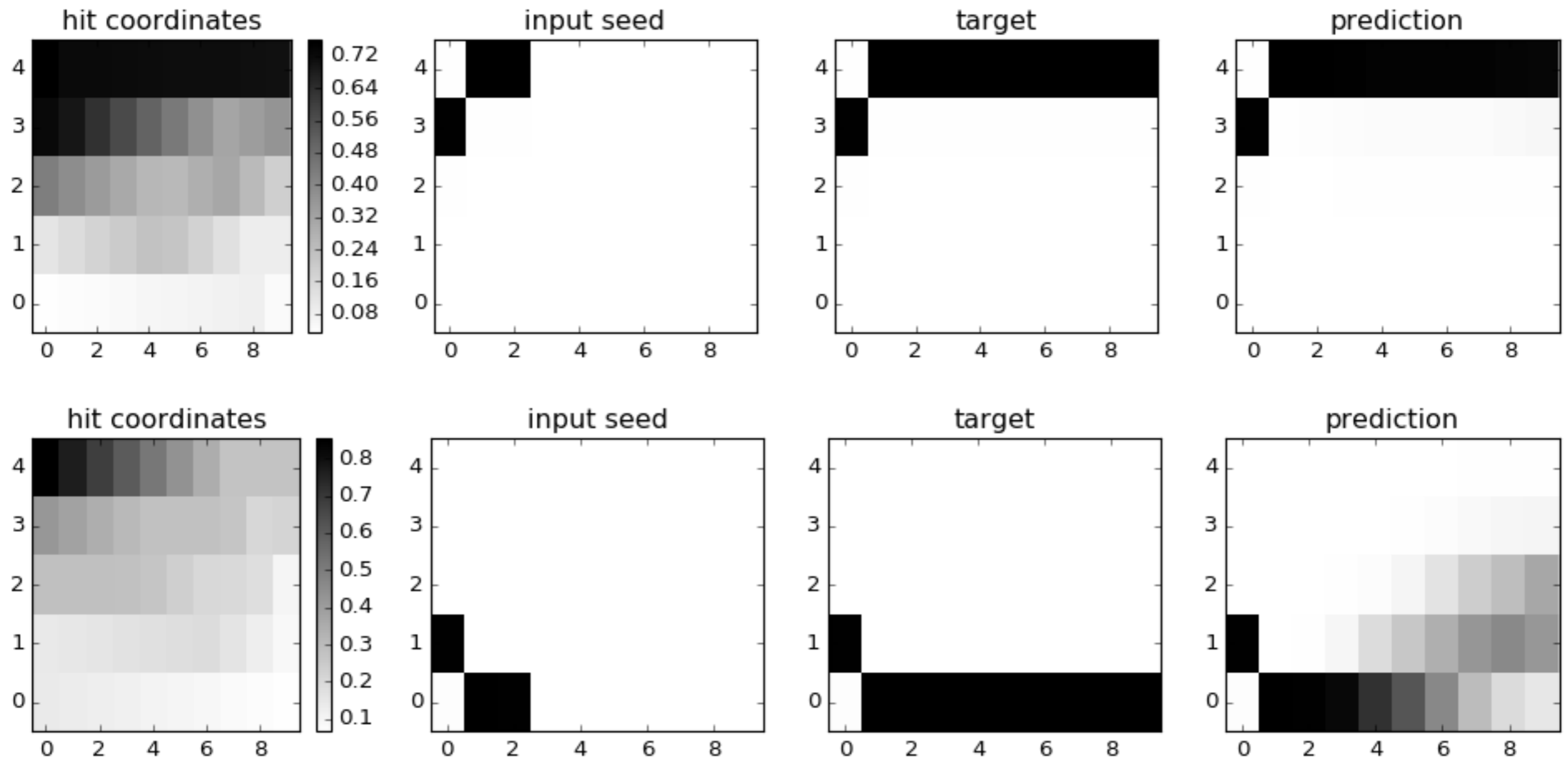
- Arrange sorted hit positions into a matrix X
 - reasonable dimensionality, full precision
- Use a NN to classify the hits
 - fully connected
 - LSTM
 - convolutional

Fully connected



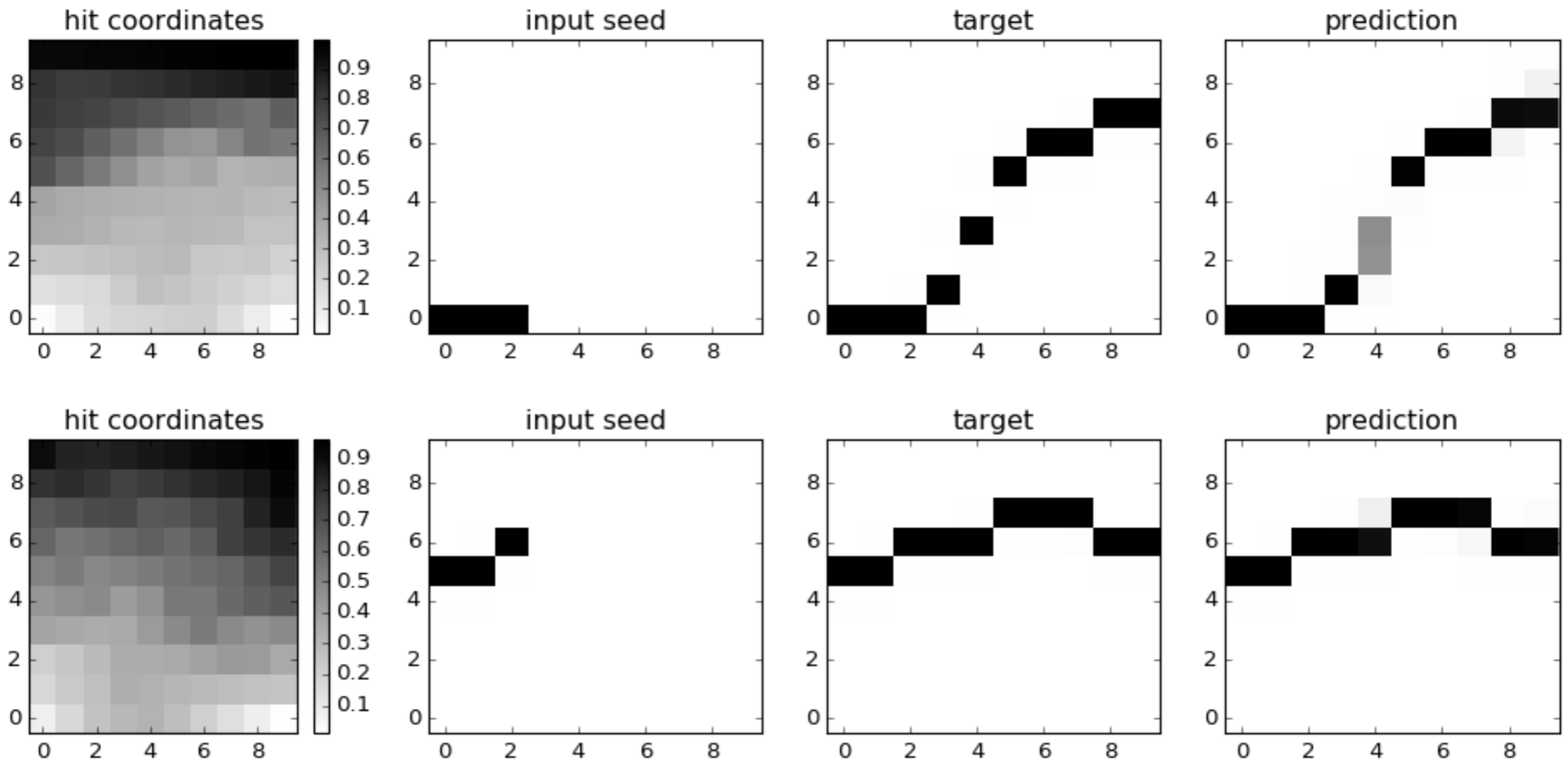
- Seeded single-track hit classification, with a window size of 5 hits
- Successfully classifies the hits on each layer, finding the correct one of the 5

LSTM



- I just ran this in the last hour; undertrained, but it was converging
 - converges faster than the FC, but slower than the CNN (next)

Convolutional network



- CNN learns local functions of neighbor coordinates, capturing most of the important information
- Kind of a poor man's graph convolutional network
 - not using the closest neighboring hits, but the closest in the sorted hit matrix
- Works, trains a lot easier than the fully connected network

My plate

- Continuous space models
 - https://culture-plate-sm.hep.caltech.edu:8193/notebooks/sfarrell/trackml/Al-HEP.Trk/gnn/Graph_dev.ipynb
 - Just a little more work to demonstrate their effectiveness (e.g. try 3D)
- Graph convolutional neural network
 - Need to do some exploratory work to figure out the best definition of “neighborhood” and a weighting kernel
 - I’ll put together some slides to illustrate the relevant concepts
- ACTS digitization production
 - I’ll put together a more useful output file (than the existing CSV one)
 - then we can run our models on this