

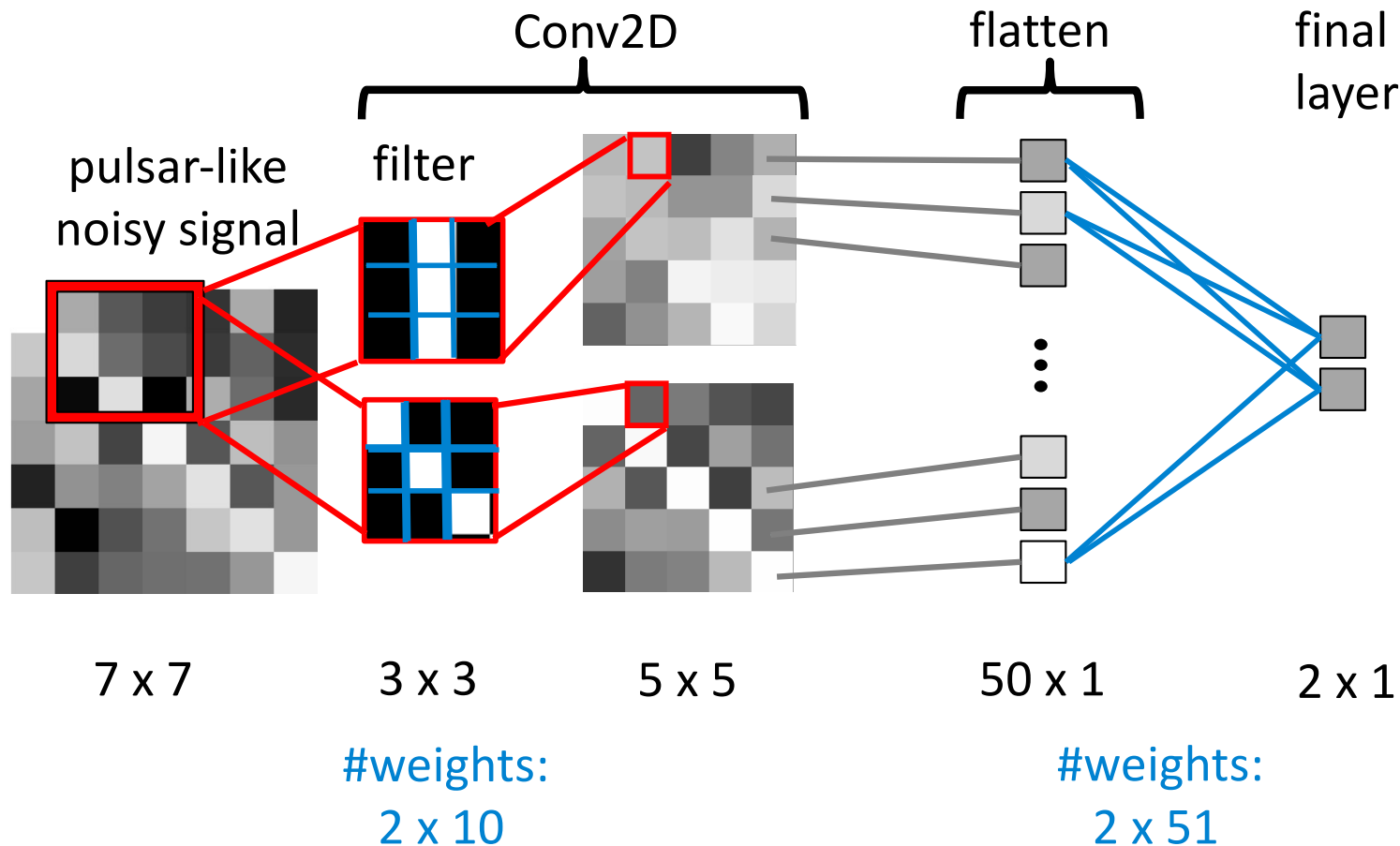
Simulation Pipeline for Pulsar Analysis (SPPA)

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Convolutional Neural Network (CNN)



- o Andrei's CNN: 160 filters
 - n Layers: $3 \times (\text{Conv2D} + \text{MaxPool}) + \text{flatten} + \text{final} \Rightarrow$ #weights: up to 3.2 Mio.

Filters after training (400 images + 15 epochs)

predefined initial values

random initial values

- o pulsar filter



(after training)

- o RFI filter



(after training)



(after training)



(after training)

Validation: classification results (2 classes: pulsar + RFI, 100 test images)

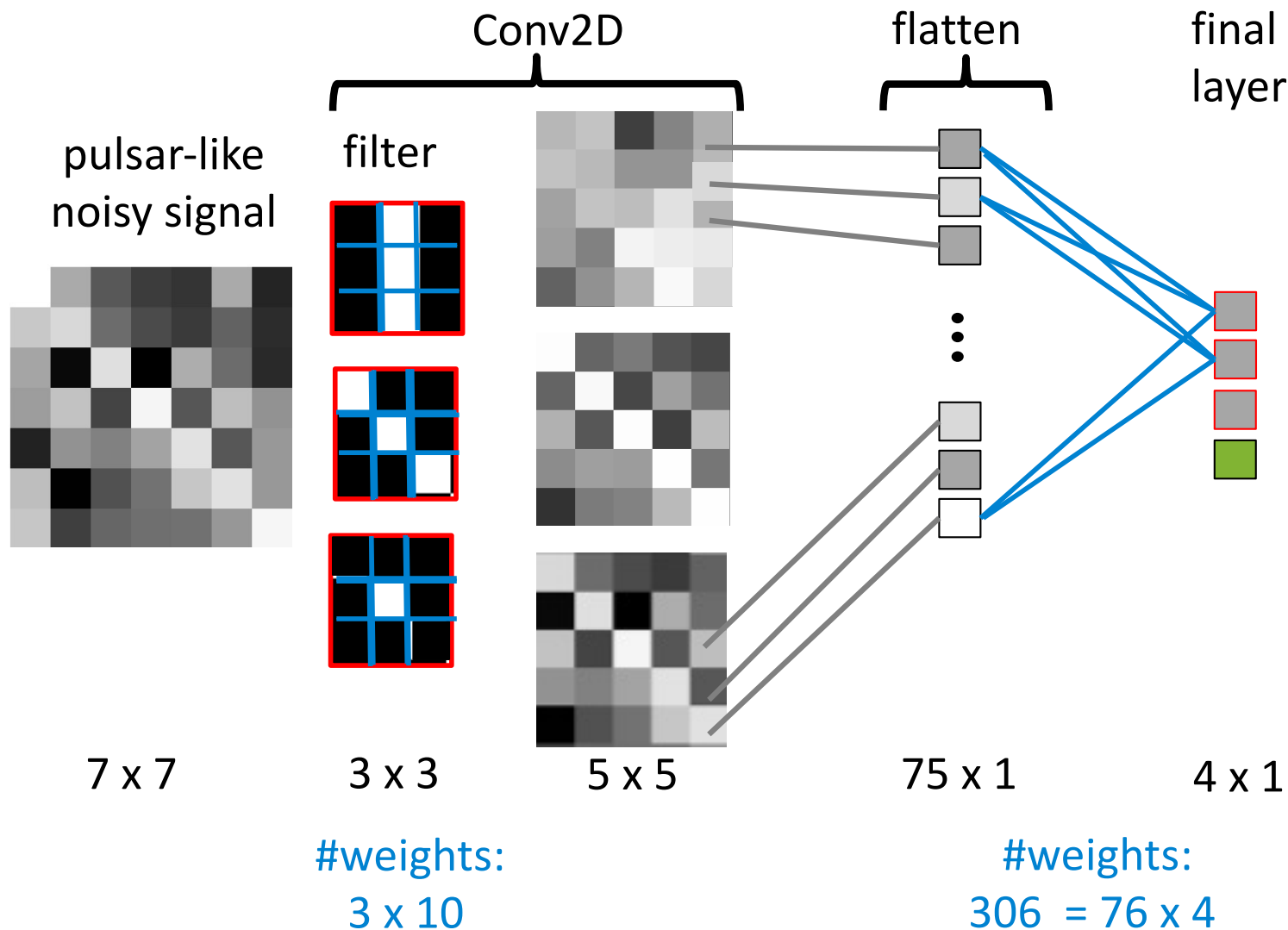
“Testing Accuracy” = 1.0

“Testing Accuracy” = 0.975

Conclusions

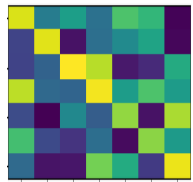
- o Despite correct classification results, CNNs do not learn “physically meaningful” filters (even from images with high SNR).

What about non-signals and „unknown“ signals? 1

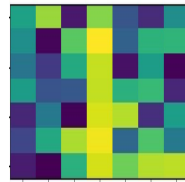


What about non-signals and „unknown“ signals?

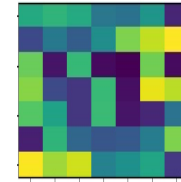
4 training sets (500 images per set):



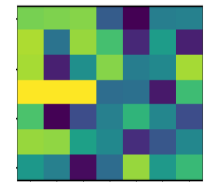
pulsar



RFI

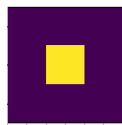
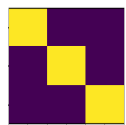


non-signal

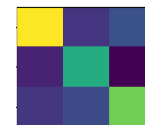


„unknown“

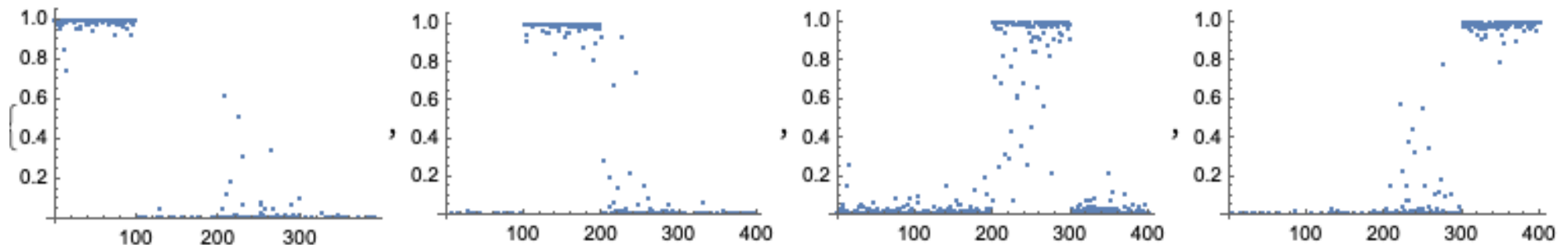
(Only) 3 filters (initial values)



after training (50 epochs)



Outcome of the 4 neurons @ final layer for each image of the validation set



“Testing Accuracy” = 0.978

Conclusion: CNN with one Conv2D layer and predefined filters might be sufficient.