EEG Classification via CNNs

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NeuroHack at Yandex

1. 24 hours

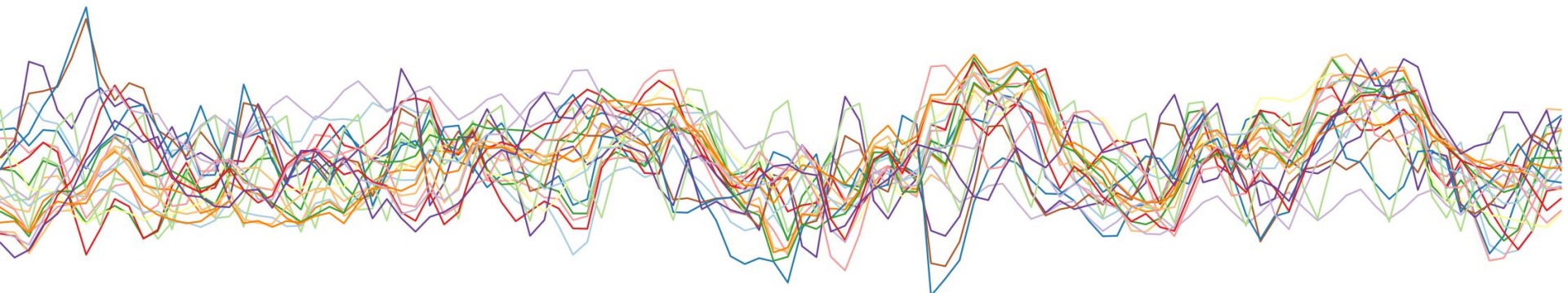2. Three tasks

3. Weird ruleset

Tasks

1. Realtime prediction of EEG signal

2. EEG classification

3. EMG to pen coordinates (seq2seq)

Task 2: testing

Classify each timestep into one of 3 classes

Input: 1125 timesteps, 24 channels, 250Hz

Output: class probabilities for each timestep

Task 2: metric

Averaged ROC-AUC for each class (one-vs-all)

Tuning probability scores is useful!

Task 2: training set

1. Four patients
2. ~10 minutes of data (over 100k timesteps)

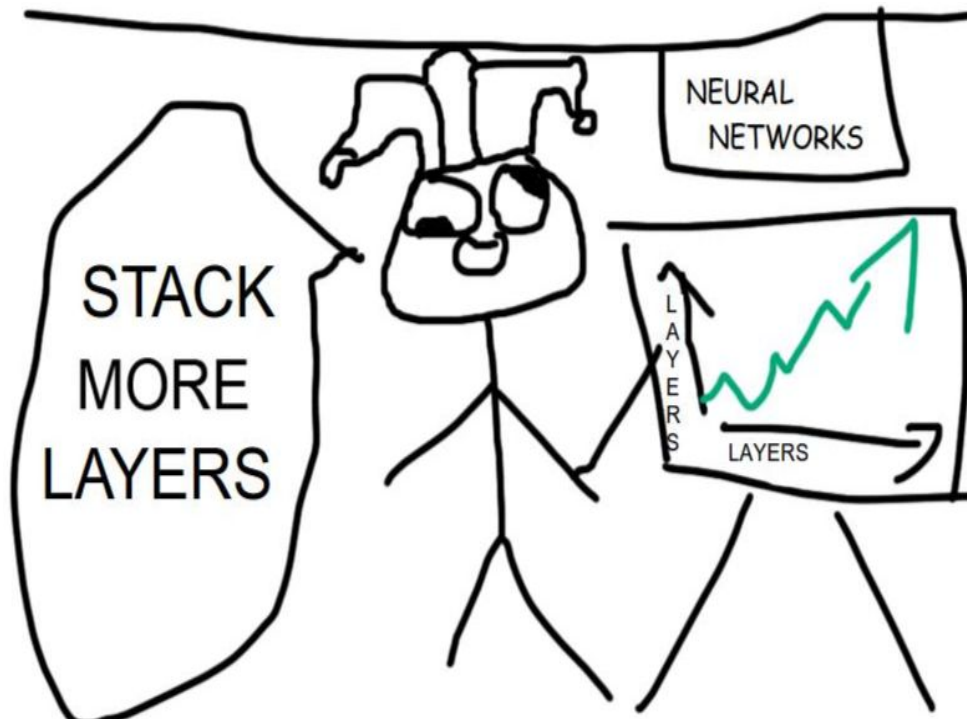X set: batches of 1125 subsequent ticks of uniform class

Y set: class value for each batch
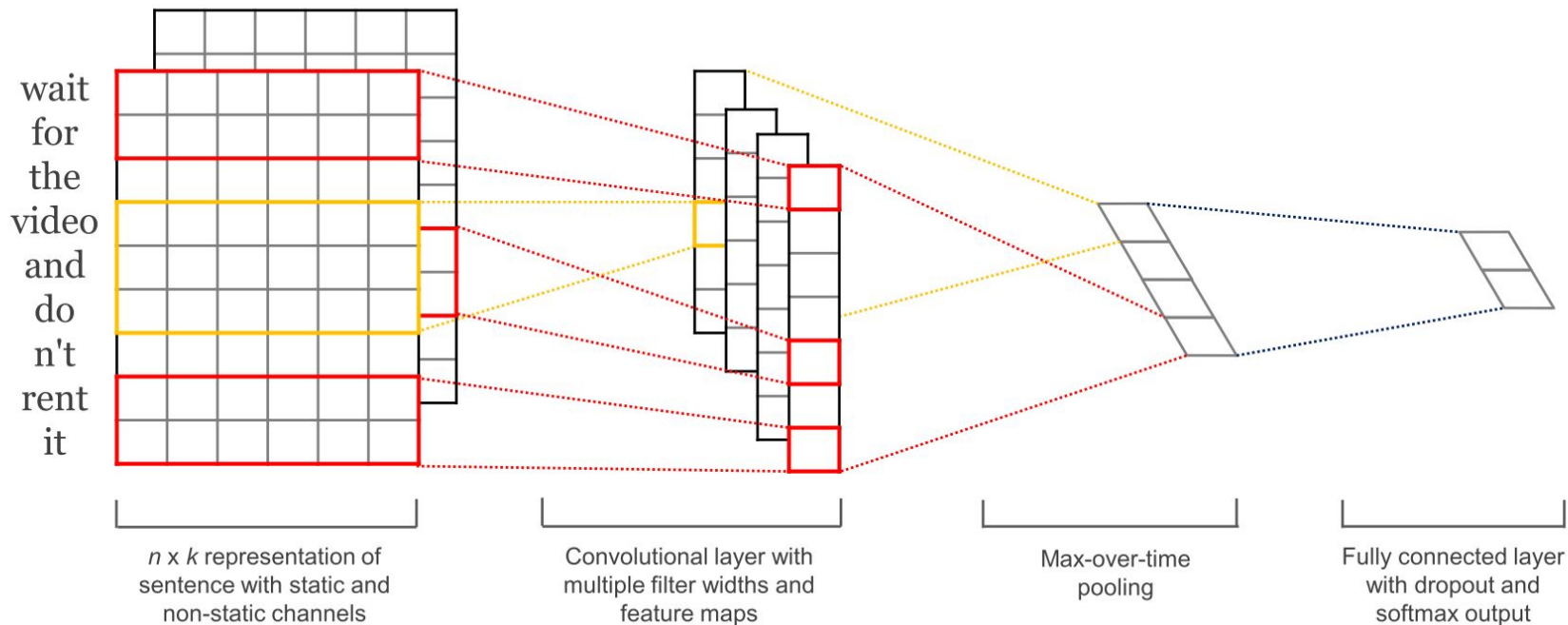
Solution Idea: use 1D Convnets

Because xgboost is so 2016…

1D Convnets have been successfully applied to various time-series related tasks

WaveNet is a notable example

1D Convolution

wait
for
the
video
and
do
n't
rent
it

n x k representation of
sentence with static and
non-static channels

Convolutional layer with
multiple filter widths and
feature maps

Max-over-time
pooling

Fully connected layer
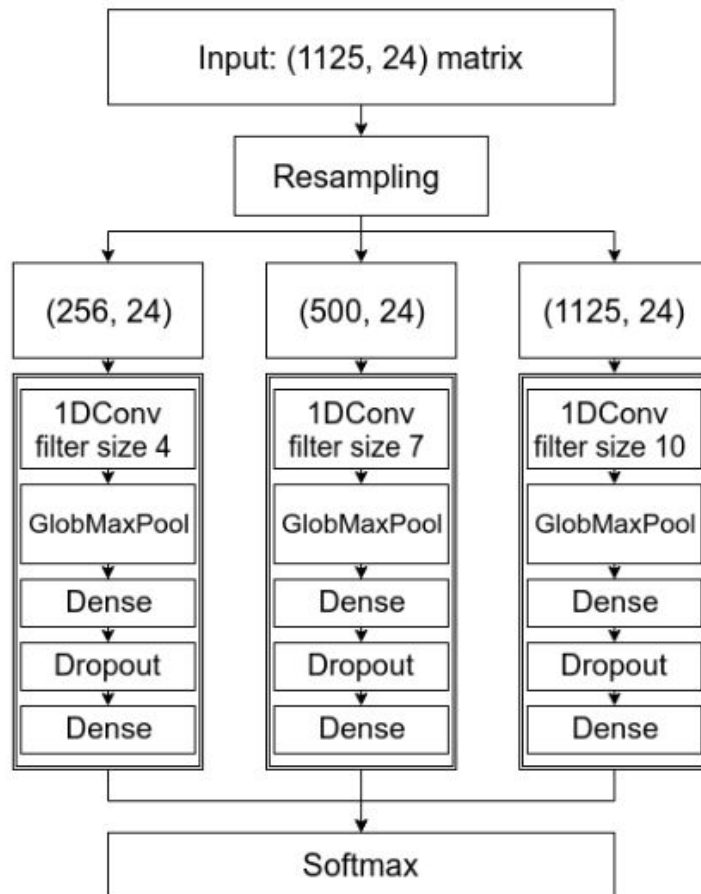with dropout and
softmax output

Multiscale 1D Convnet

Input resampling will allow to extract features at different time scales

All convnets are learned jointly
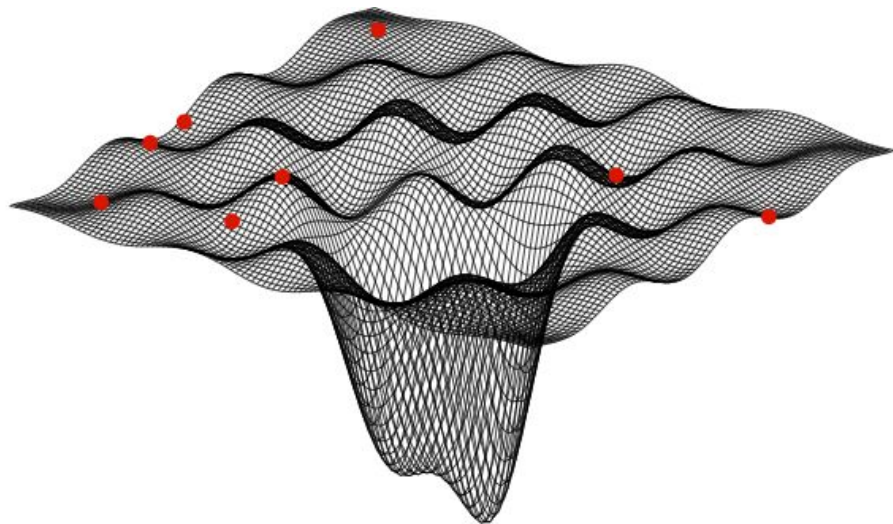
Implemented in Keras+TF

Postprocessing: autoblending

Blending usually works well as an additional regularization
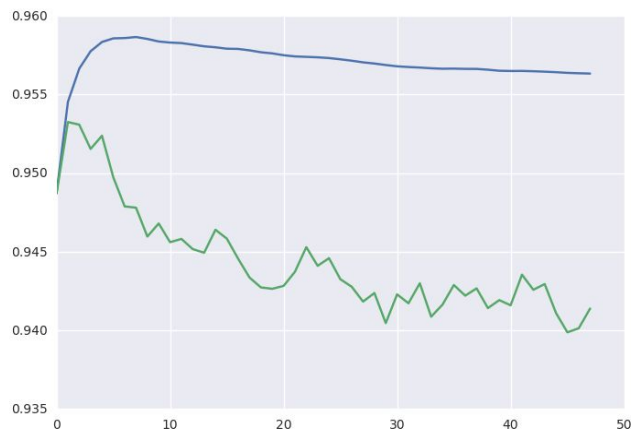
Training NNs takes a lot of time

Let's blend a single NN with itself on different stages of training!

Autoblending Experiments

IMDB Movie Reviews

1D CNN, Accuracy

MNIST

MLP, AUC

Final Results

| # | Участник 🔍 | | NeuroHack 2016 | |
		1	2 ∧	3
1	dmitry.f.kozlov	191770	9228	5475
2	polina.polunina	0	9168	5463
3	have-you-ever-retired-a-human	—	9005	—

Pros:

- No filtering
- Patient labels are not used at all

Cons:

- Unable to handle chunks with varying states

Future Work

Try this approach in real-time.

Test if the classifier works on previously unseen people.

Write a paper?

Links

github.com/kiselev1189/EEGClassificationMCNN - Source, refactoring is coming

arxiv.org/abs/1603.06995 Multi-Scale Convolutional Neural Networks for Time Series Classification