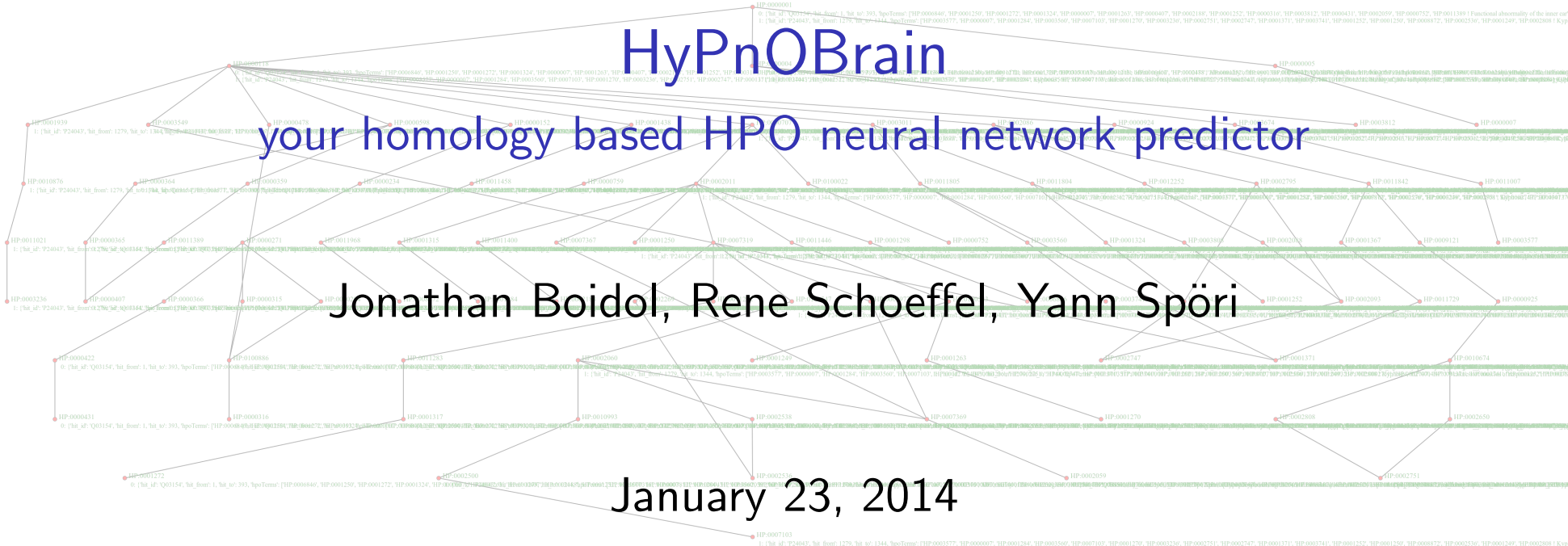

HyPnOBrain

your homology based HPO neural network predictor

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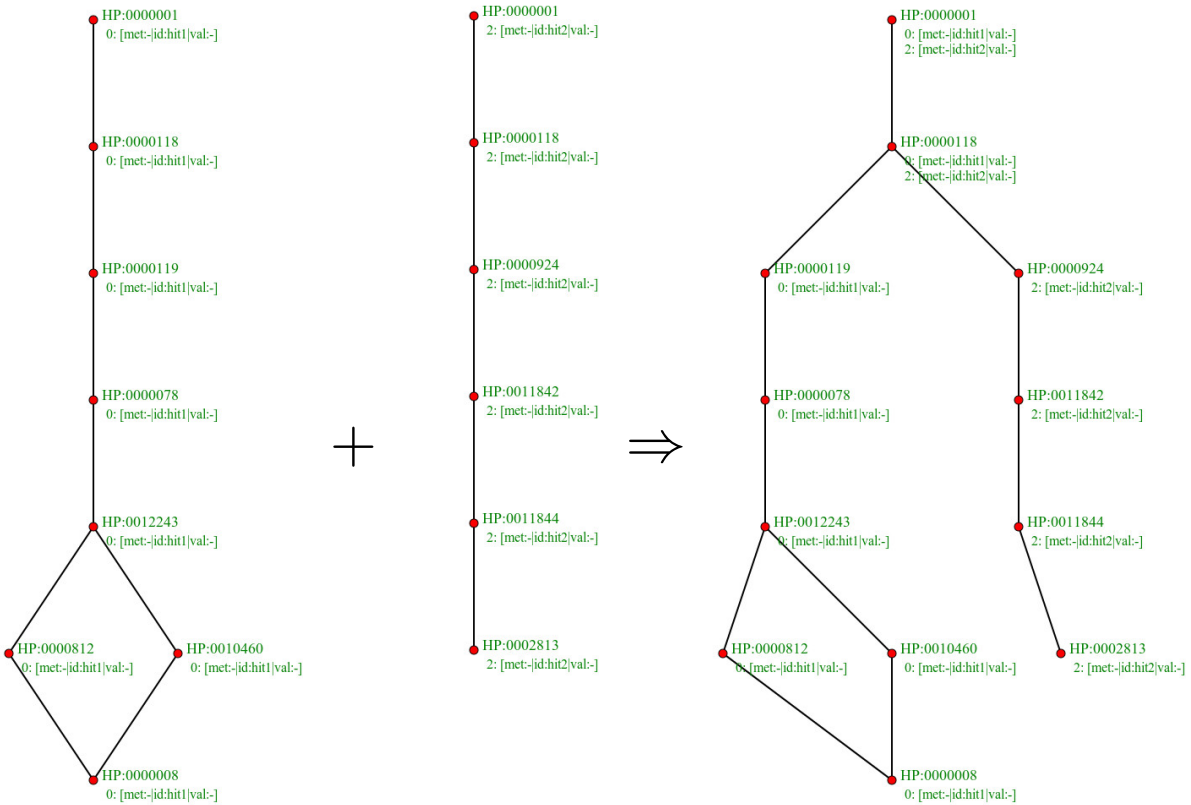
Homology based function prediction

General approach:

- Search for annotated similar sequences (hits) and transfer annotations
- HPO is hierarchical: Merge found annotations from different hits
- Calculate confidence for every annotation from some distance measure to the hits

Preparations

- Prepare databases for annotated sequences
- Represent HPO Graph in predictor
- Merge trees corresponding to hits



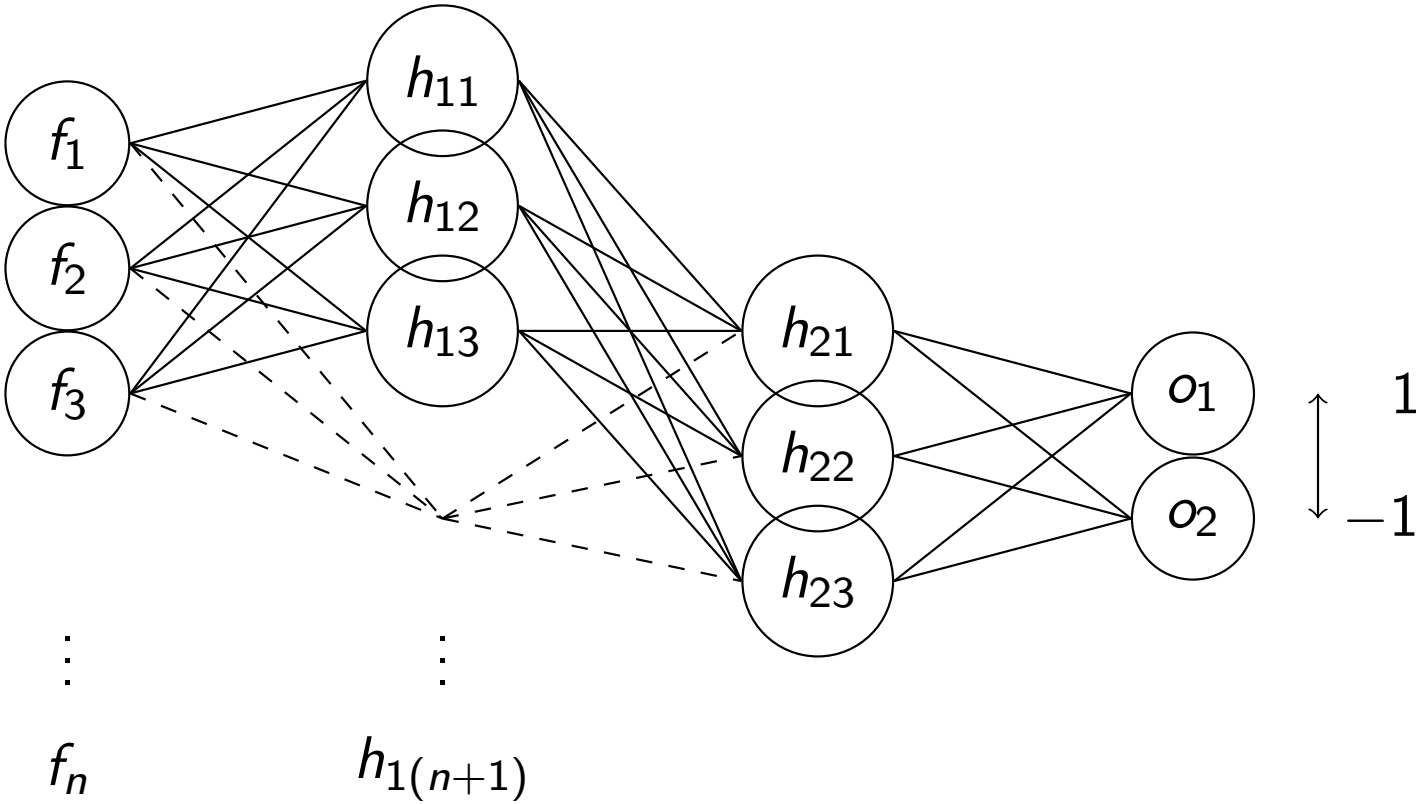
Features

- each node is assigned 12 features derived from the merged tree
  - length of query sequence
  - number of hits
  - longest hit
  - avg. hit
  - min. E-value
  - avg. E-value
  - product of E-values
  - best E-value from blast or hhblits
  - min. height in HPO-tree
  - max. height in HPO-tree
  - max overlap of query and all hits
  - length of best hit

  } [3, 0.0074, 0.45, 4.2e-7, 84, ...]

- use neural network to calculate confidence per node

Final network architecture



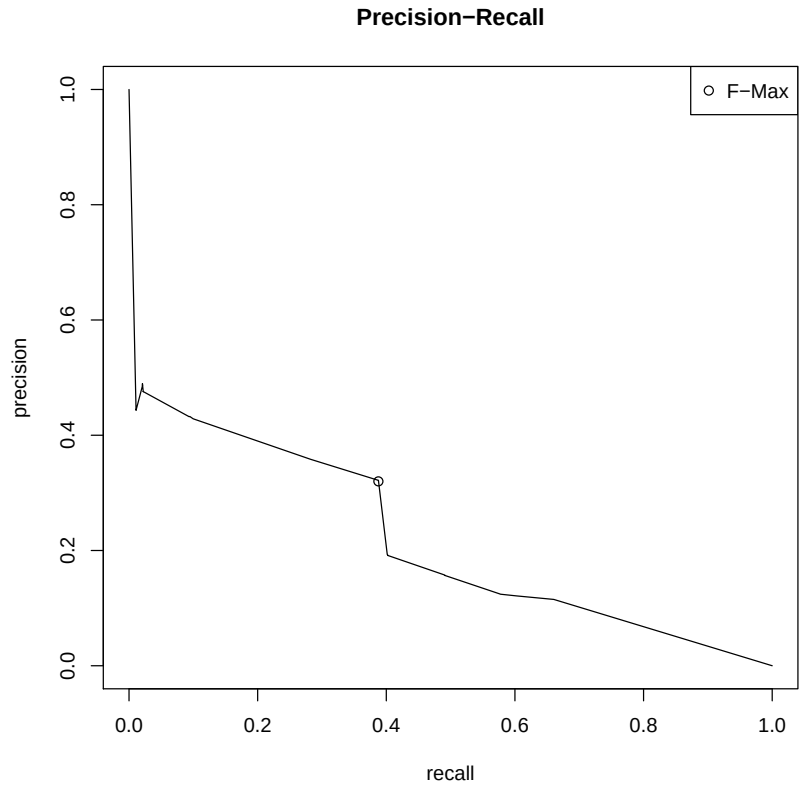
- different architectures evaluated
- fully connected net with two hidden layers
- two output nodes trained for the two possible predictions
- difference of predictions as confidence

Validation

- Inspection of the dataset shows: Most sequences have pairwise similarity $< 80\%$

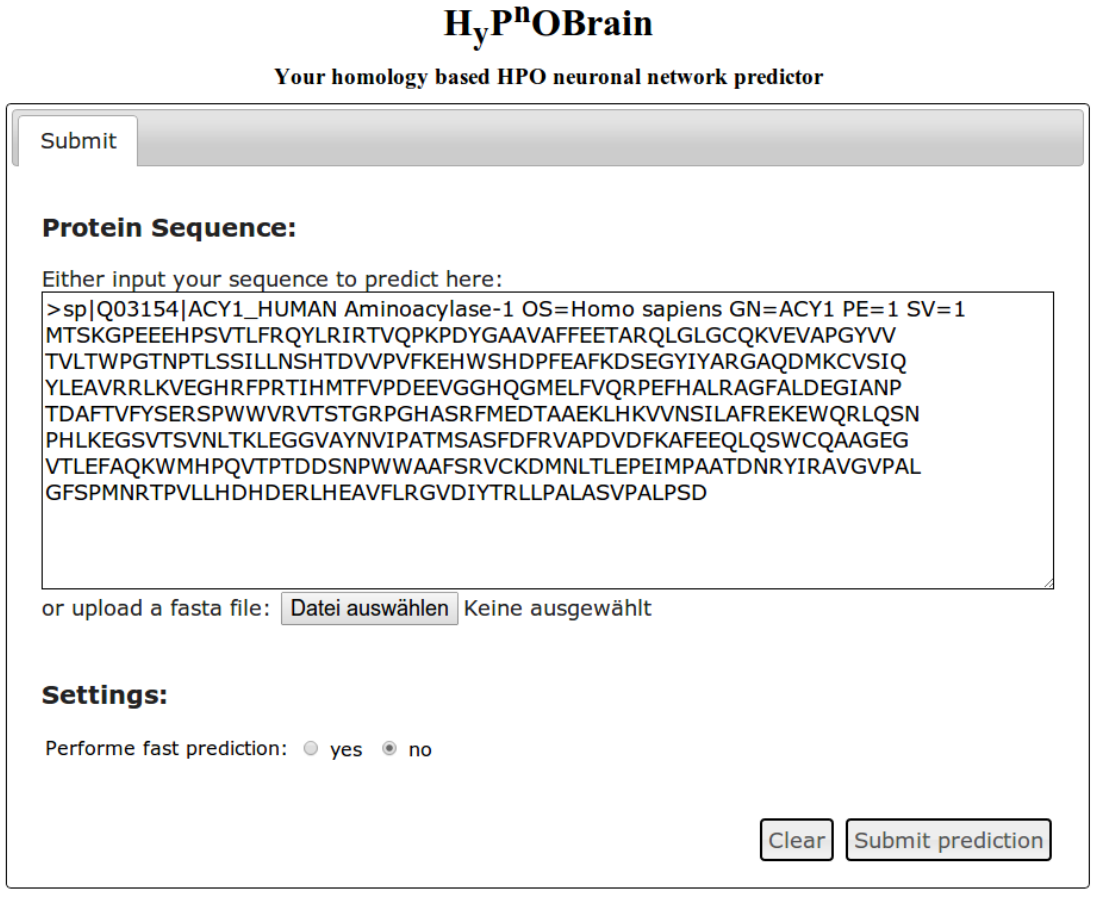
  $\Rightarrow$ no significant bias in the dataset caused by very close homologs
- 10-fold crossvalidation over 2815 sequences
- Calculate precision and recall per test sequence and average over all sequences
- Final model trained on all sequences

Results



- F-measure 0.35 ± 0.03 (at confidence level 0.34)
- Precision 0.32 ± 0.04 (at same confidence level)
- Recall 0.39 ± 0.10 (at same confidence level)

HyPnoBrain Online



- `https://dataminer.informatik.tu-muenchen.de/~spoeri/`
- file or text field input
- option to speed prediction up by restricting hits to 6 best

Productive waste of time aka: Future Improvements

- Incorporate SVG output of results in webinterface
- Feature evaluation and improvement
- Investigate effect of homologs in dataset
- Different network architectures
- Other machine learning devices