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Singing Voice Detection with Deep Recurrent Neural Networks

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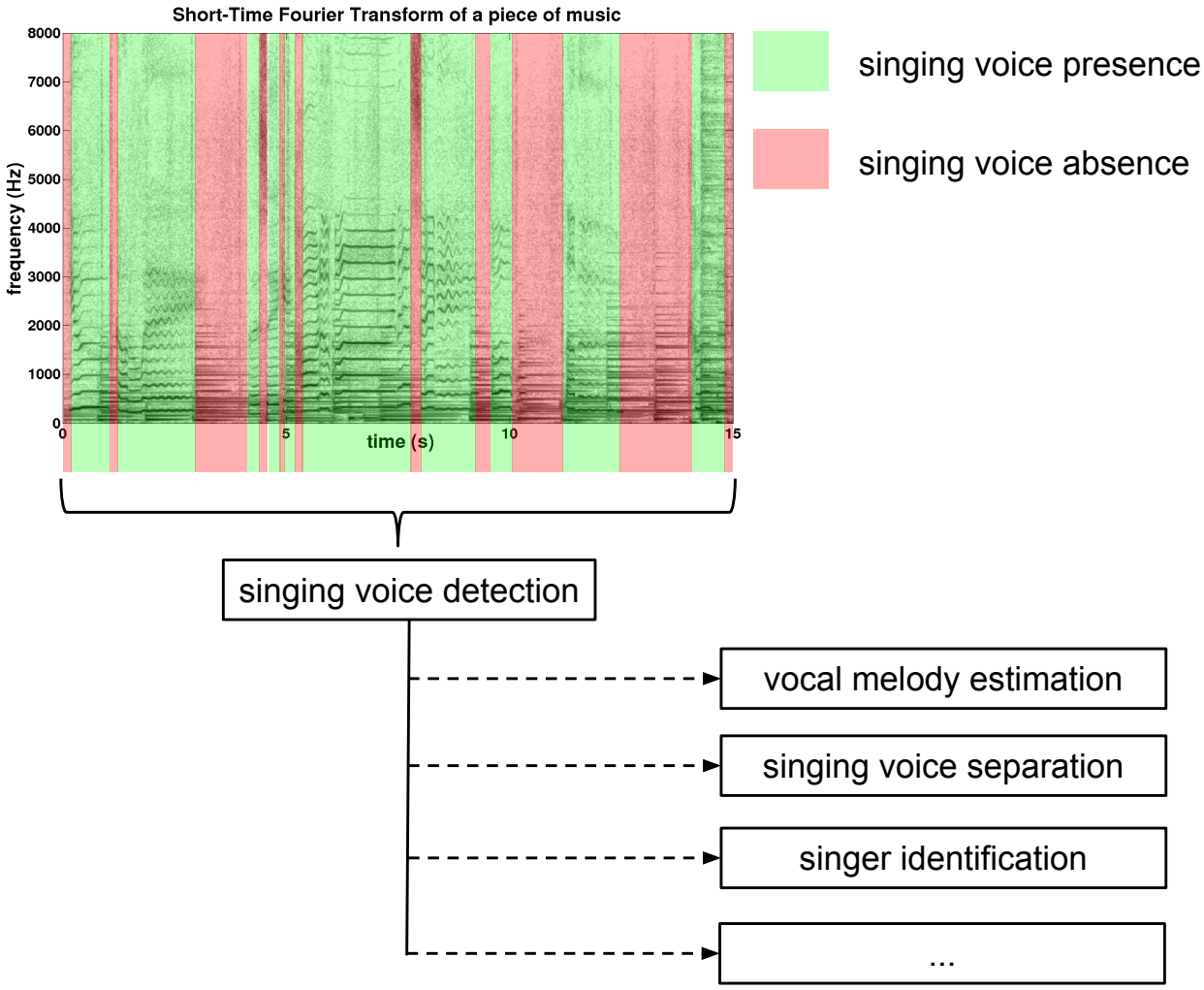
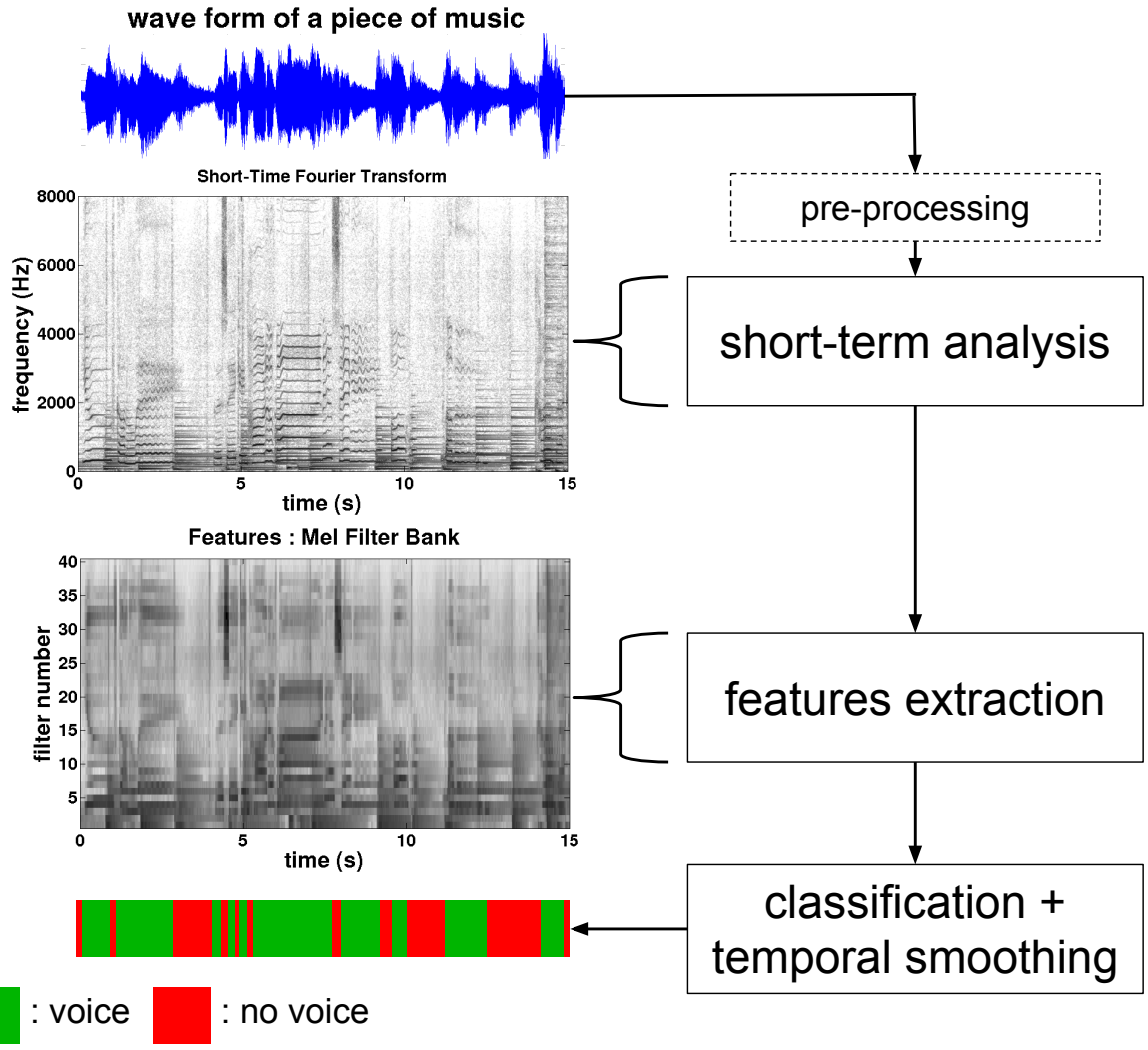
Introduction



Introduction



Introduction

Our method :

- Bidirectional Long-Short Term Memory (BLSTM) Recurrent Neural Network (RNN)

  $\longrightarrow$ long past and future **temporal context**

- With several hidden-layers

  $\longrightarrow$ extract simple useful information from **low level features**

Outline

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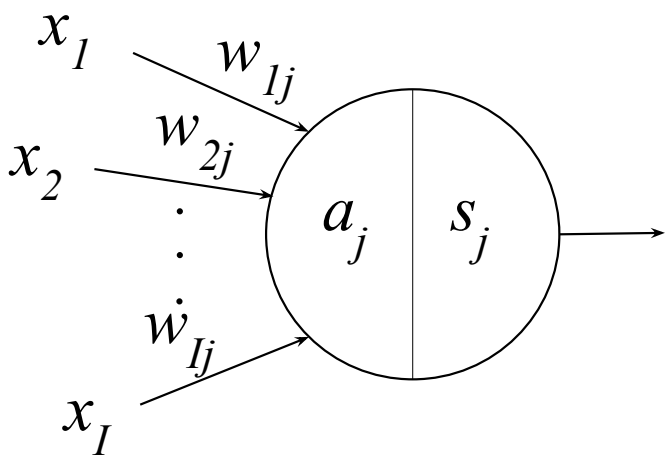
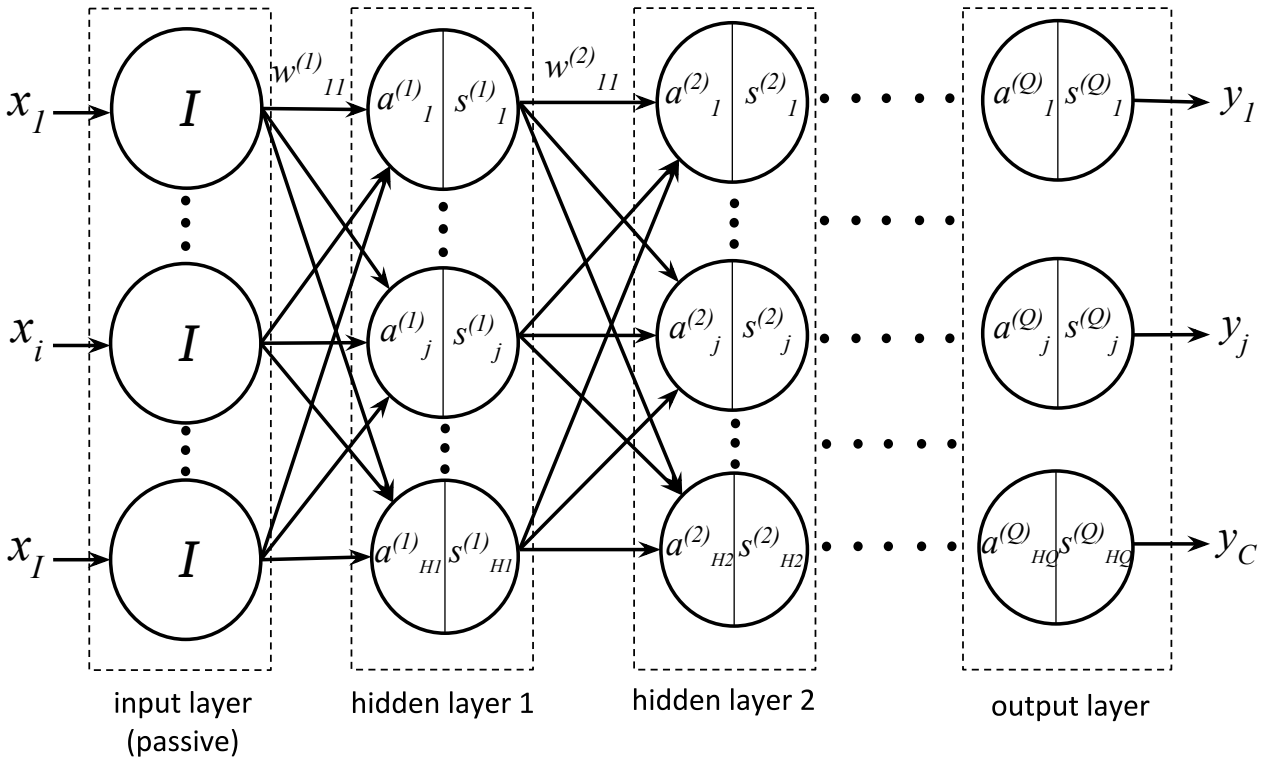
Formal Neuron

- **Activation** : $a = \sum_{i=1}^{I} w_i x_i$
- **Output** : $s = f(a)$ with f the nonlinear activation function (e.g. step function, sigmoid, hyperbolic tangent, ...)

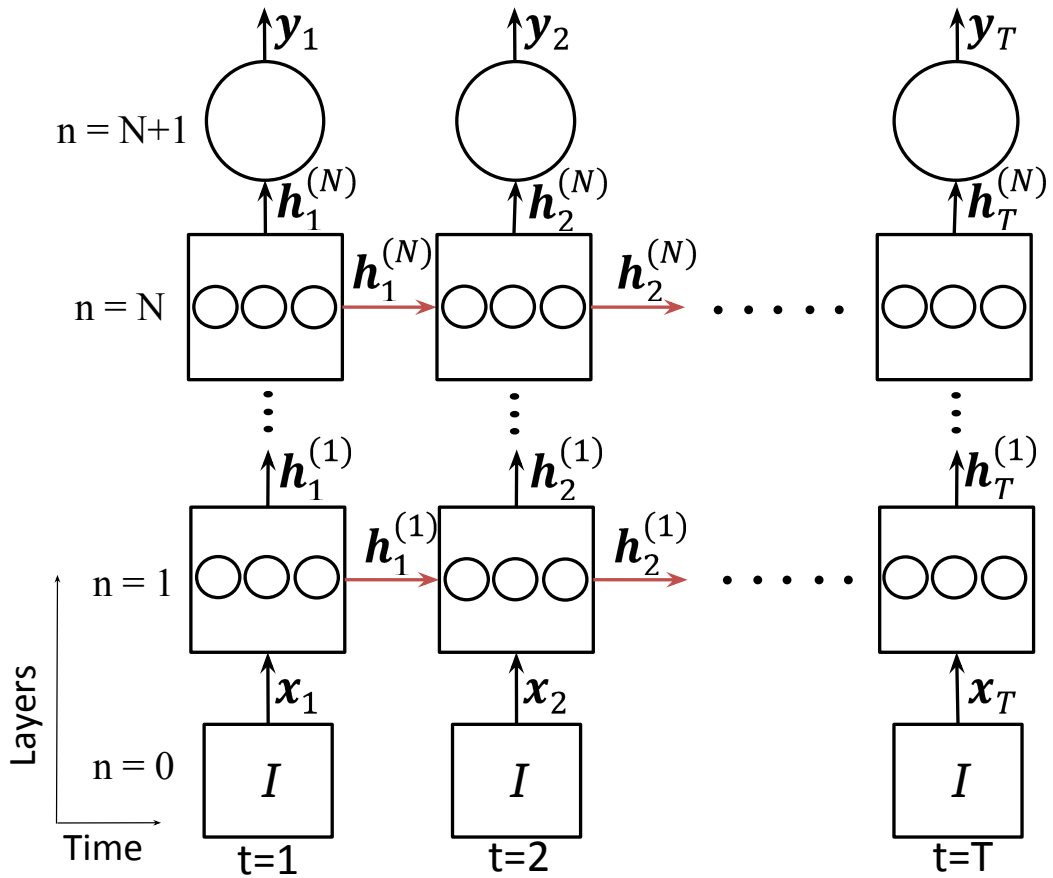


Multi-Layer Perceptron



- Feedforward Artificial Neural Network
- Maps inputs to outputs by propagating data through the layers
- Training : Gradient descent using backpropagation

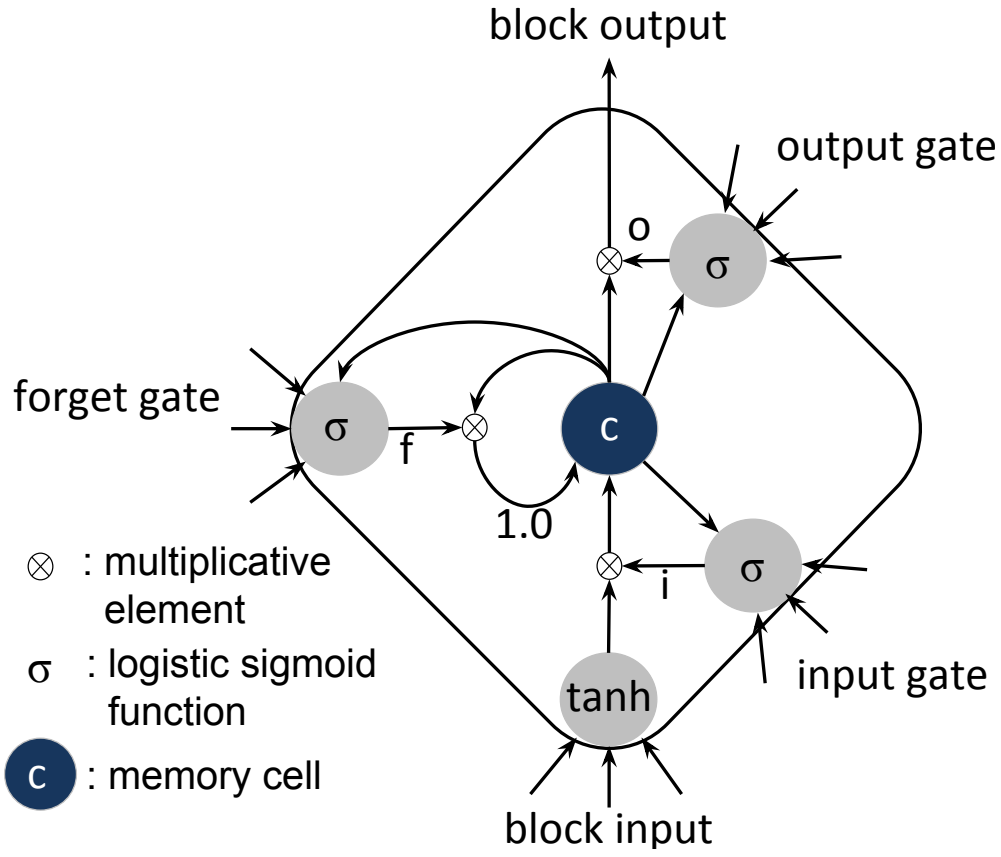
Recurrent Neural Network



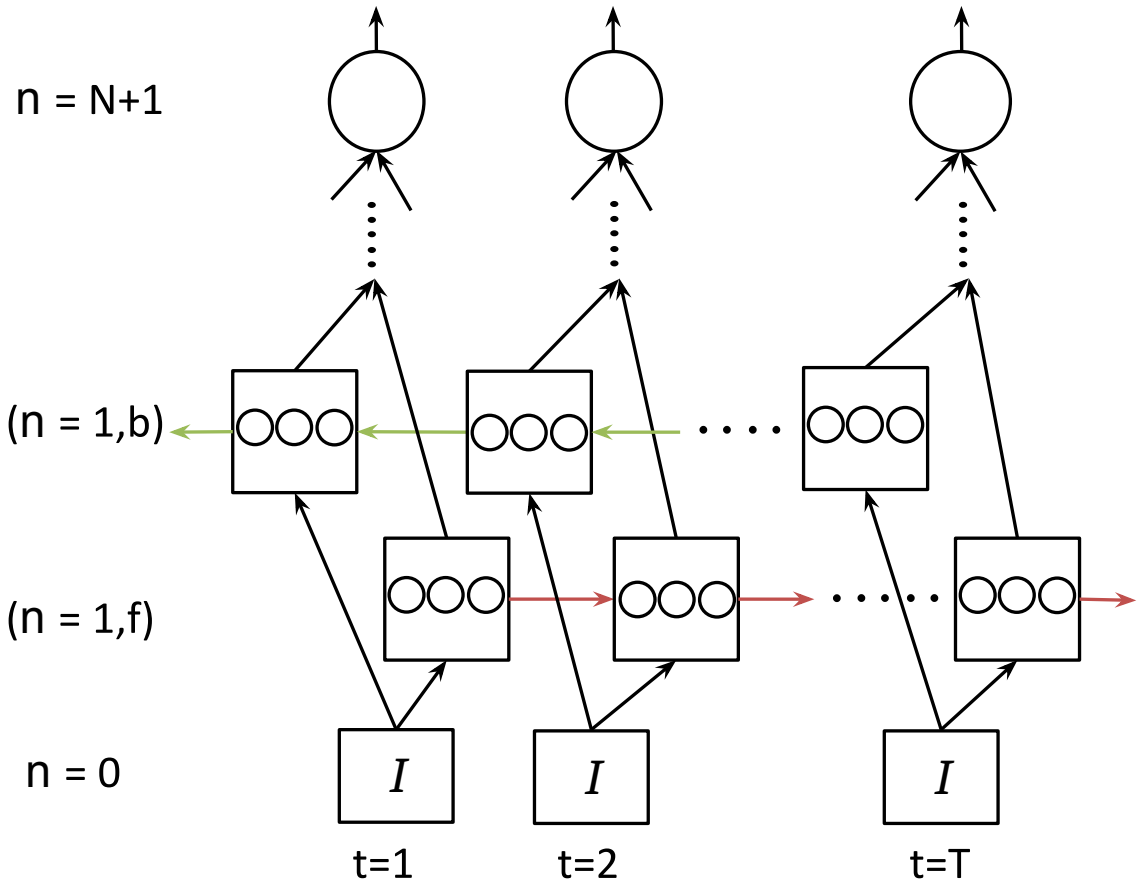
Recurrent Neural Network unfolded in time

Long Short-Term Memory

- Memory cell
- Input Gate, Output Gate, Forget Gate = Write, Read and Reset



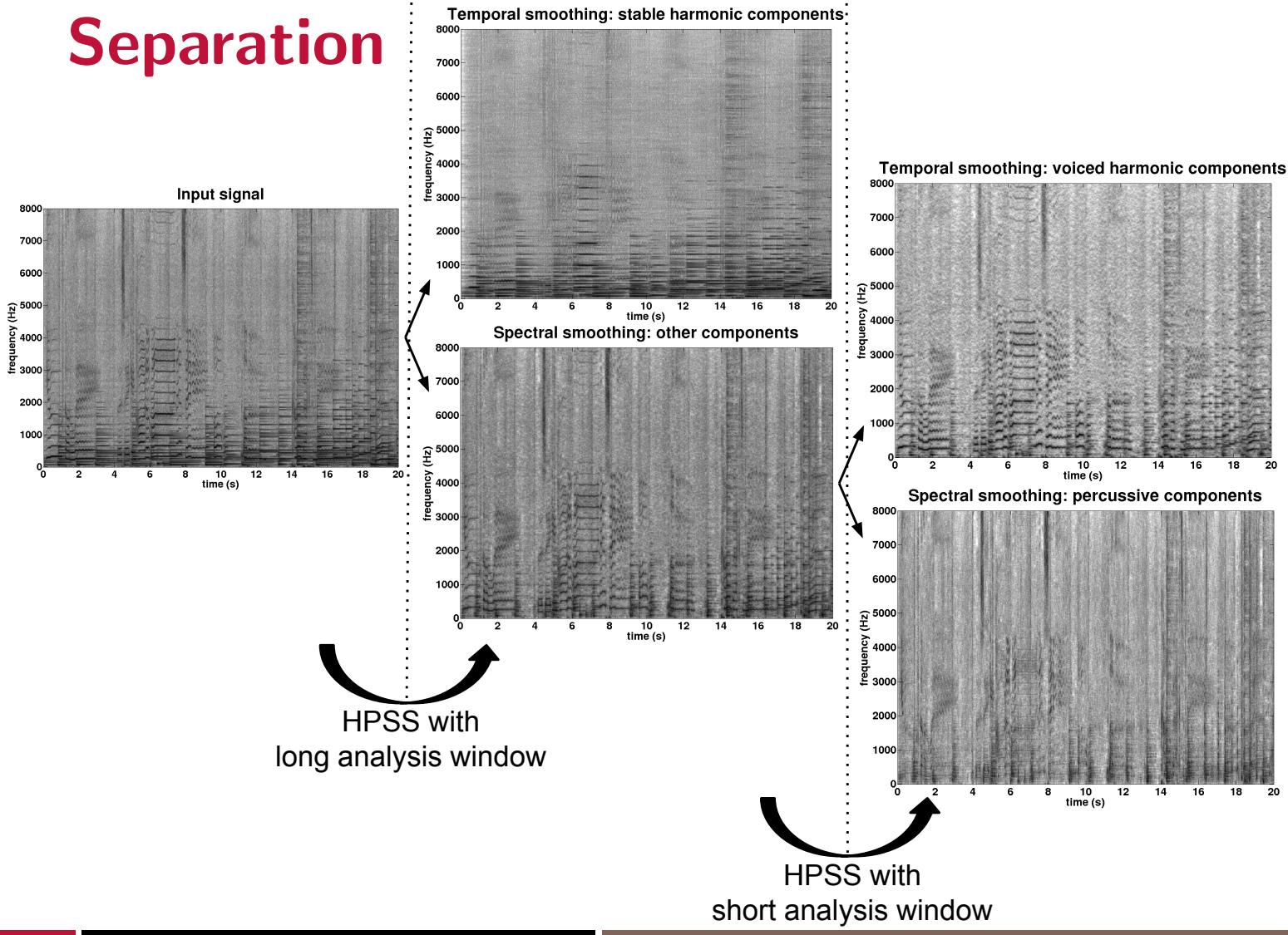
Bidirectional Recurrent Neural Network



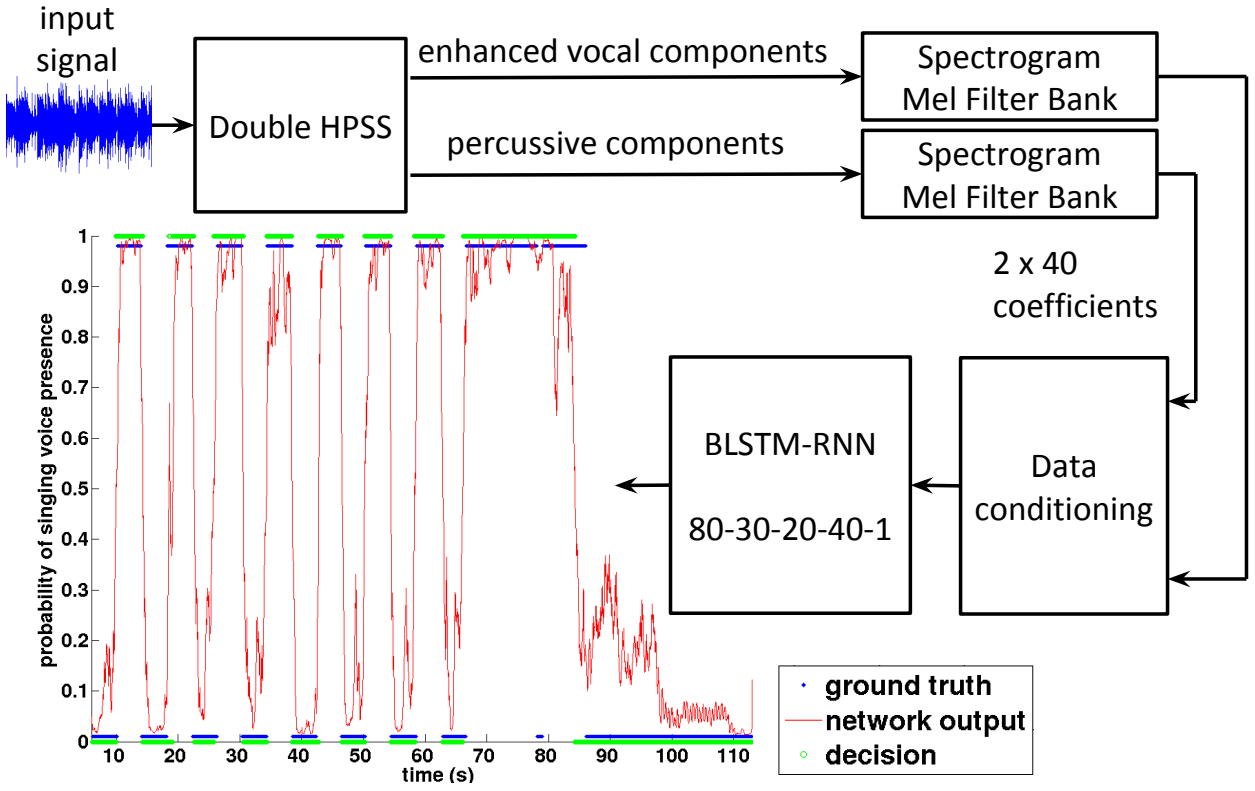
Bidirectional Recurrent Neural Network unfolded in time

Outline

Double Harmonic/Percussive Source Separation

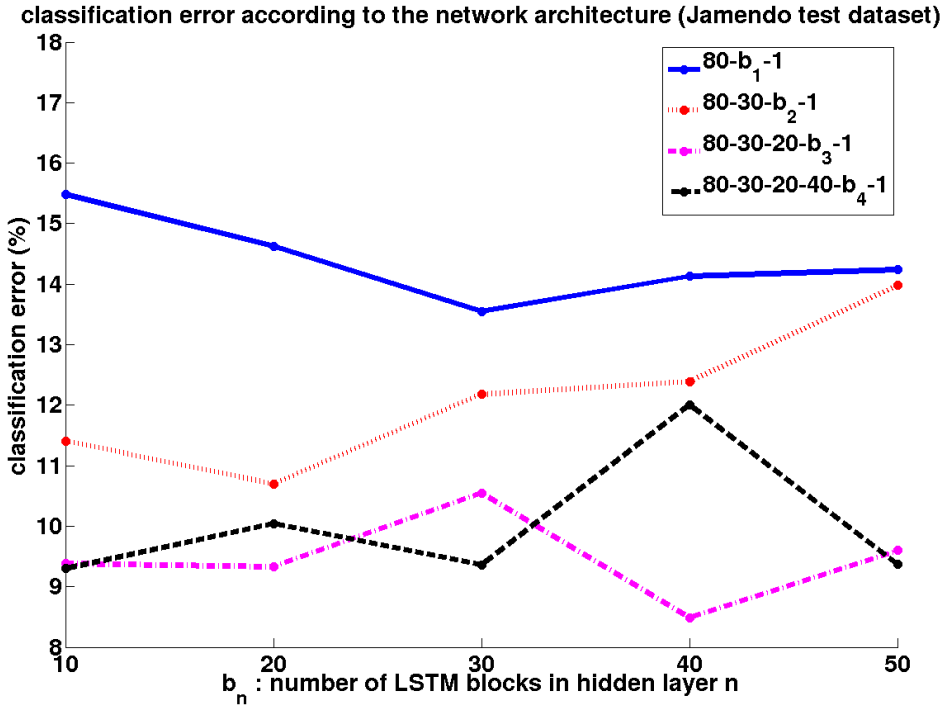


Global System



Building the Network

- No theoretical evidence $\longrightarrow$ empirical approach, not much discussed in papers
- Incremental procedure : depth increased by progressively adding hidden layers

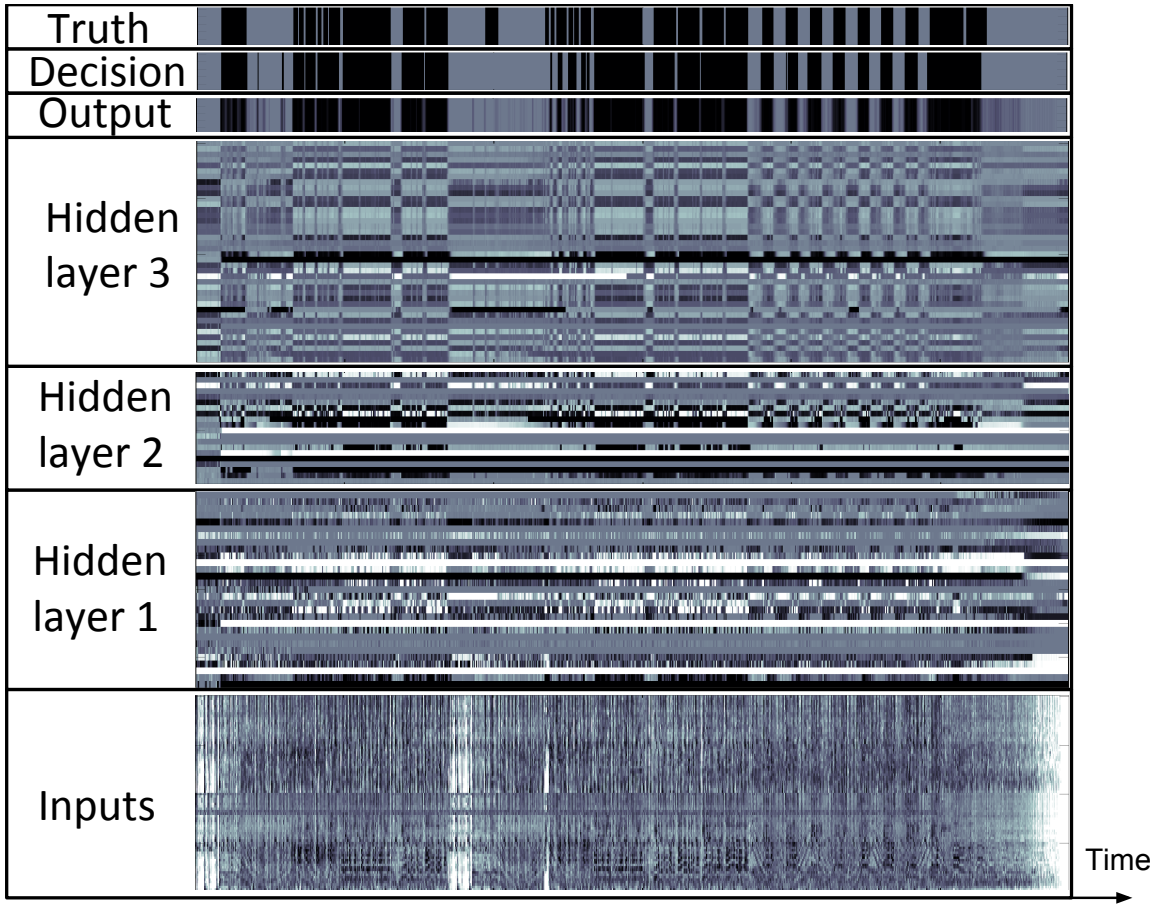


Outline

Jamendo : A Common Benchmark Dataset

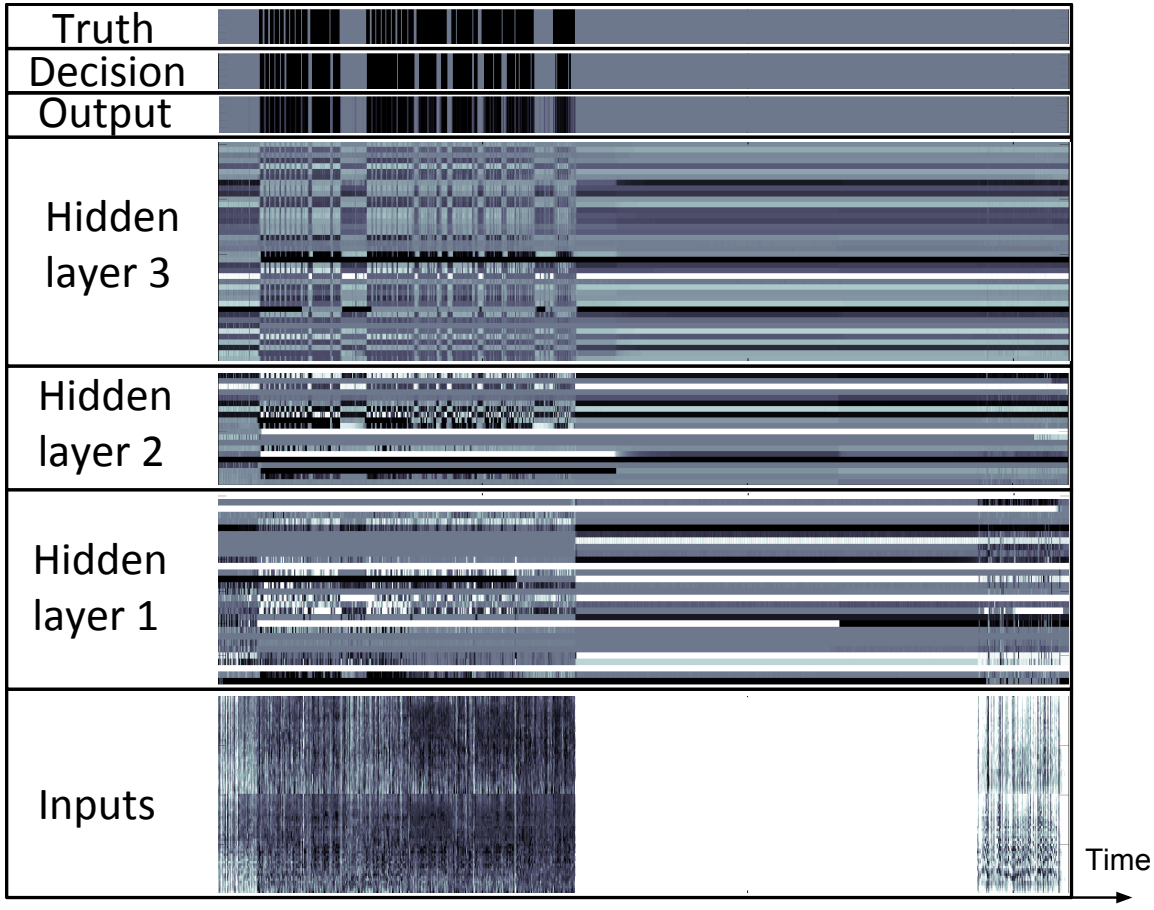
- Publicly available dataset
- Singing voice activity annotations
- Training set : 61 files
- Validation and Test sets : 16 files each
- Common database $\longrightarrow$ fair comparison of our approach

Internal Netwok Functioning

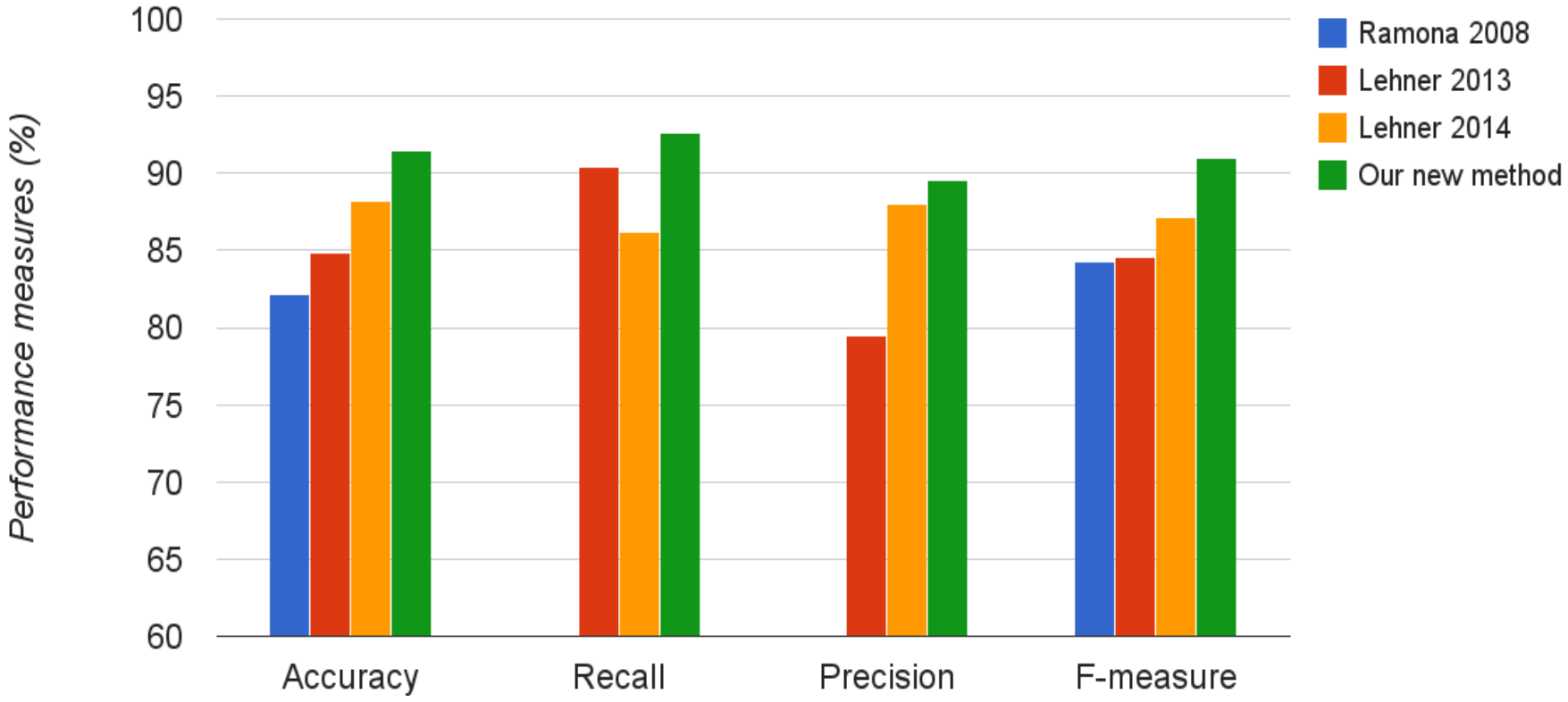


Color scale between -1 (white) and 1 (black)

Consideration of a Temporal Context



Results on Jamendo Dataset



Conclusion

- New approach for singing voice detection
- We do not focus on defining a complex feature set
  $\longrightarrow$ may be suboptimal
- We make use of neural networks to extract a simple representation, fitted to our task
- A past and future temporal context is considered by the classifier
  $\longrightarrow$ no need for temporal smoothing
- The results we obtain encourage further work with BLSTM-RNN in MIR for sequence classification tasks, e.g. melody estimation

Thank you