CTC LSTMs

Seminar: Spoken word recognition

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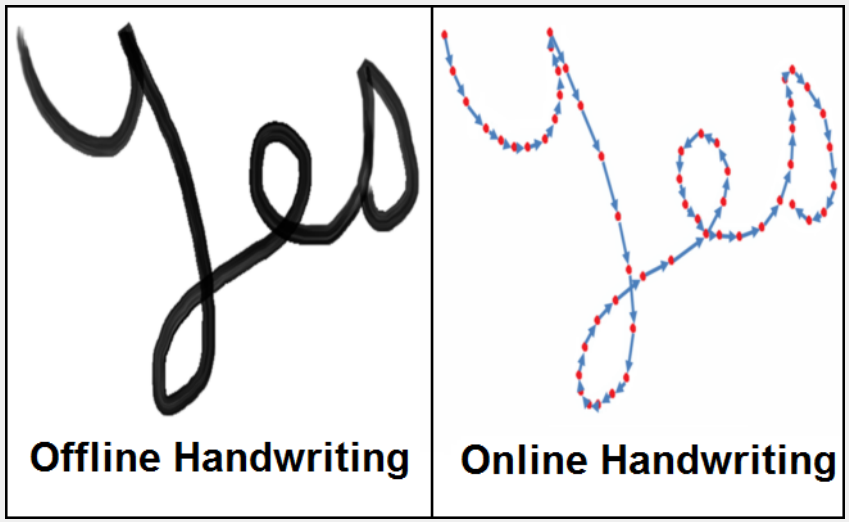
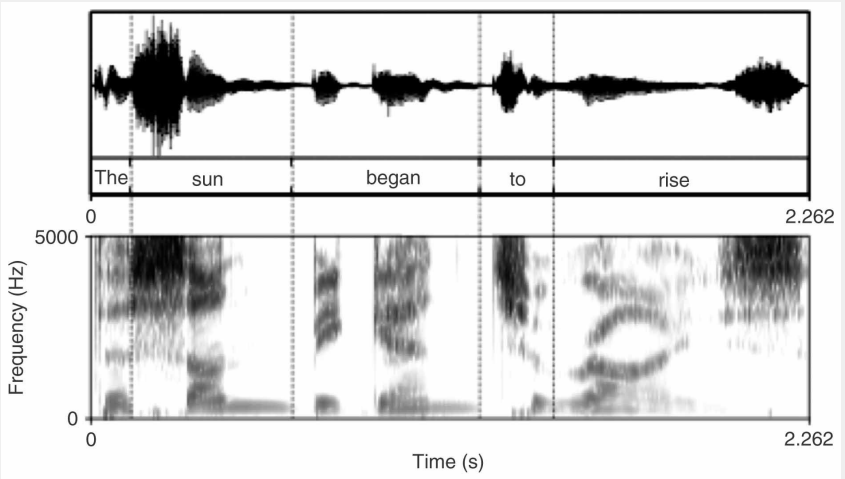
Motivation

on-line handwriting recognition



on-line spoken word recognition



Introduction

- Networks for sequential data (e.g. RNNs like LSTMs)
- What about variable timings?
  - Traditional models require alignment (e.g. text-audio)
  - Rate of speech/writing varies individually
- **CTC LSTMs can classify sequential data with variable timings**

CTC LSTM

- **CTC**: Connectionist temporal classification
- **Input**: On-line observations (unaligned)
- **Output**: Continuous probability distribution over all possible labels
- **Training**: Output distribution should fit the probability of each label
- **Loss**: Maximize probability for correct answer

$$\Longrightarrow \text{ Training using normal backpropagation}$$

Example

0. Train with alphabet $\{h, e, l, o, \epsilon\}$
1. Input: Spectogram (on-line)
2. Feed into LSTM (or other RNN)
3. Returns probability distribution
4. Compute probability of all sequences
5. Merge repeated tokens, remove ϵ

Conclusion

- Better than most methods (e.g. Markov chains)
- Probably replaced by attention models (transformers)
- **CTC LSTMs can classify sequential data with variable timings**

thanks

Example code:
`github.com/marvinborner/ctc-lstm`