BERT's Handwriting

Testing BERT Word Prediction Effect on Accuracy in Handwritten Text Recognition

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Introduction

- Handwritten text recognition is essential to digitization of data and modern workflow
- The BERT encodings have pushed the boundaries of many NLP tasks—could it improve HTR accuracy?
- Can BERT can predict a word from context that normal HTR might miss?
- Relevant metrics:
  Character Error Rate (CER)
  Word Error Rate (WER)

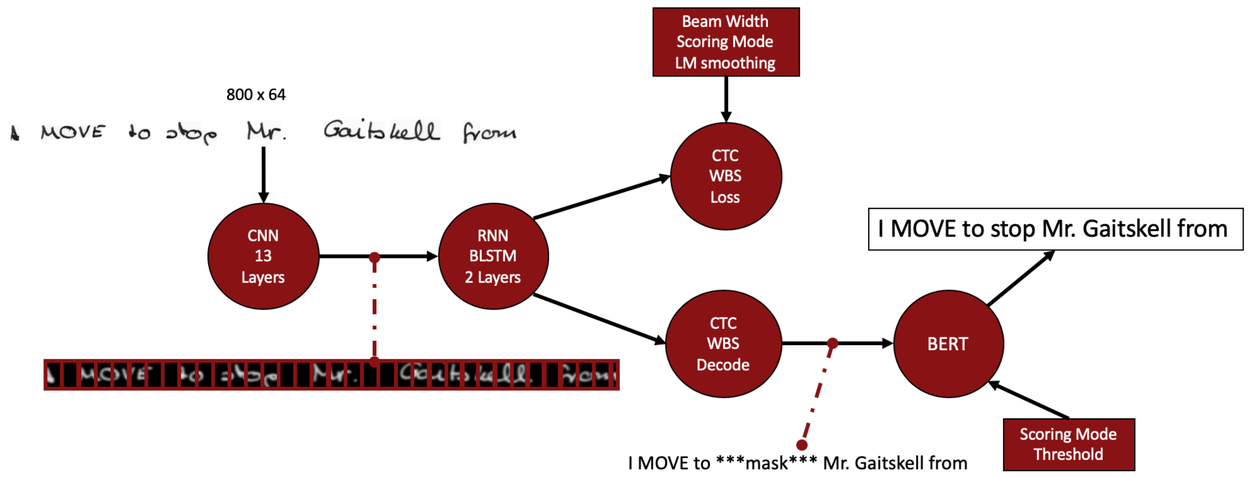
Data

- IAM Handwriting Database
- 13,353 isolated and labeled text lines from 657 different people

CTC Loss and HTR

- Connectionist Temporal Classification is the fastest and most accurate method of training BLSTM output
- Current research being done to best decode CTC output
- Current methods are beam search, token passing and word beam search

Models and Method



- Key idea is to use standard HTR followed by BERT masking for low-certainty words
- A standard HTR network has a CNN followed by an RNN with CTC loss.
- CNN used leaky ReLU and max pooling (512 units) and the RNN two layers of BLSTM (256 units)
- Word Beam Search with n-grams forecasting and sampling made to restrict output to dictionary
- Words masked based on average top beam score per character in word

Results

	Train (CER:WER)	TEST (CER : WER)
Simple HTR	6.0336 : 55.6923	5.2512 : 53.0769
HTR + BERT (avg. top score)	6.0903 : 55.5385	5.2832 : 52.7692
HTR + BERT (avg. char score)	6.2773 : 57.0769	5.5491 : 54.0000

Discussion

- Disappointed BERT did not significantly increase performance of HTR models
- Results seem to be skewed by data irregularity from the train to test set results.

Future Work

- Line segmentation for paragraph input data
- Increase dataset with more variety of handwriting
- Develop metric of certainty at word level
- Expand image processing to handle real-time data

References

Key repositories and model examples:

- [1] Harald Scheidl. *Handwritten Text Recognition with TensorFlow*. https://github.com/githubharald/SimpleHTR.git 2019.
- [2] Sushant Gautam. *Handwritten Line Text Recognition using Deep Learning with Tensorflow*. https://github.com/sushant097/Handwritten-Line-Text-Recognition-using-Deep-Learning-with-Tensorflow.git. 2019.
- Melisa Qordoba and Sam Qordoba. *FitBERT* https://github.com/Qordobacode/fitbert.git. 2019.