Fast Multi-Language LSTM-based Online Handwriting Recognition

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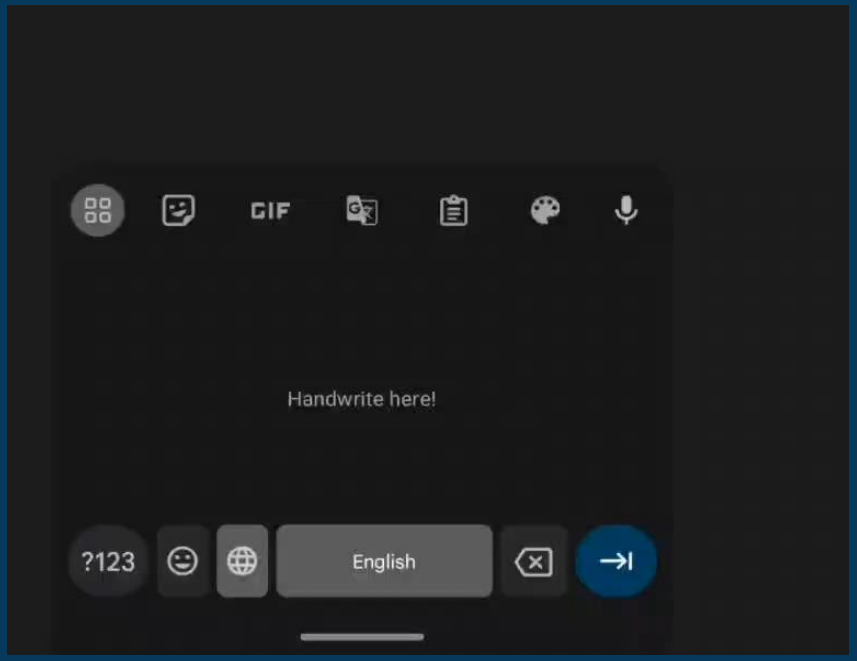
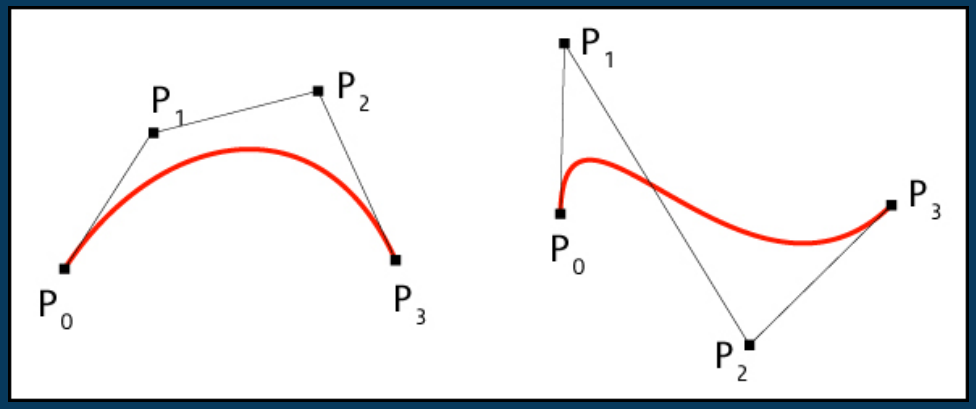
- Introduction
- End-to-end Model Architecture
- Training
- Experimental Evaluation
- System Performance

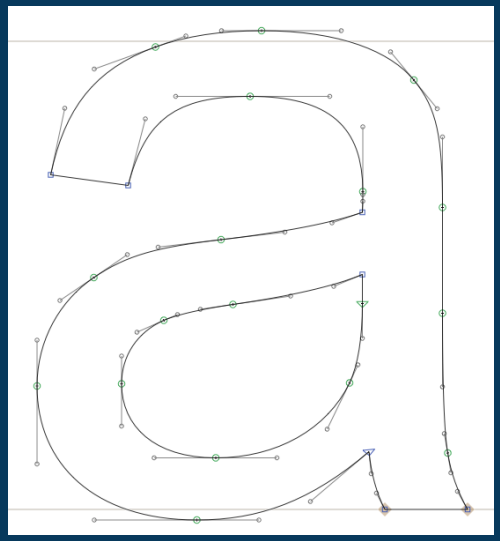
Gboard Handwriting Demo



- The characters are predicted in real time i.e not waiting for the whole word / sentence to be handwritten
- Previously predicted characters can be updated *in the future* after more context is learned (Notice how the first character changes from **J** to **F**)

Bézier Curves

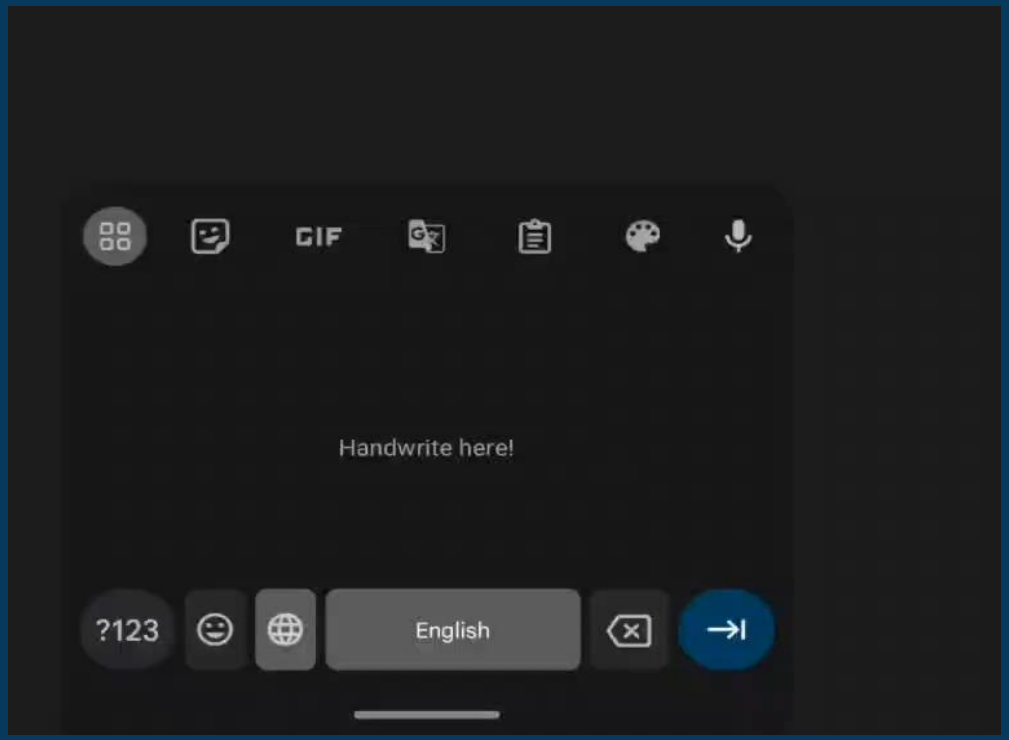




https://en.wikipedia.org/wiki/Bézier_curve

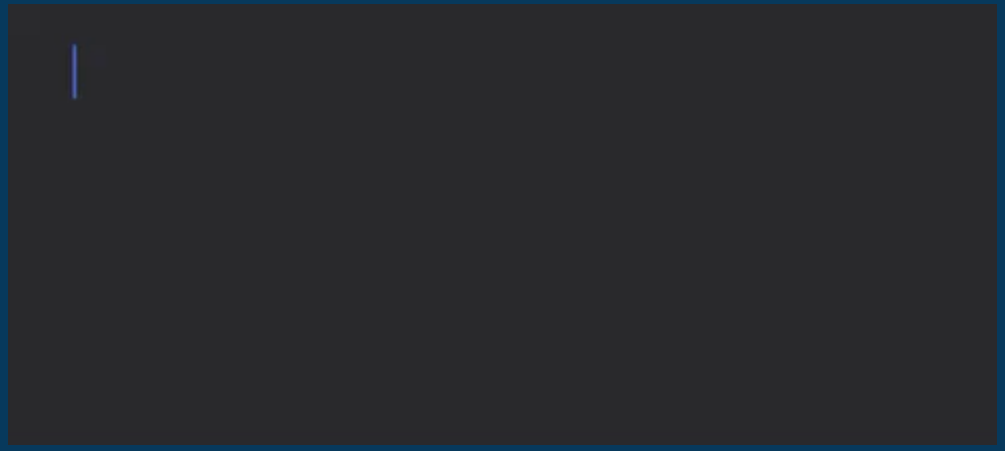
https://www.desmos.com/calculator/d1ofwre0fr?lang=fr

Comparison with Segment-and-Decode Model



Gboard

- The characters are predicted in real time i.e not waiting for the whole word / sentence to be completed.
- Previously predicted characters can be updated *in the future* after more context is learned (Notice how the first character changes from **J** to **F**)
- This is faster.



Other System

- The characters are predicted in segments i.e waiting for the whole word / sentence to be handwritten first then converting to text.
- Learning happens once after all relevant information has been captured.
- This is slower.

Useful Links

- Sequence Modeling with CTC: https://distill.pub/2017/ctc/
- Understanding LSTMs: https://colah.github.io/posts/2015-08-Understanding-LSTMs/
- Bézier Curves Wikipedia: https://en.wikipedia.org/wiki/Bézier_curve
- Recurrent Neural Networks: http://karpathy.github.io/2015/05/21/rnn-effectiveness/
- RNN-Based Handwriting Recognition in Gboard – Google AI Blog (googleblog.com)
- https://towardsdatascience.com/build-a-handwritten-text-recognition-system-using-tensorflow-2326a3487cd5
- Connectionist Temporal Classification (CTC) : https://towardsdatascience.com/intuitively-understanding-connectionist-temporal-classification-3797e43a86c