End-to-end, Full Page, Handwriting Recognition

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End-to-end, Full Page, Handwriting Recognition

1. Prior work and why assumptions they make are invalid.
2. Handwriting Recognition Method
3. Training Process
4. Results
Full Page Handwriting Recognition

1. Line Segmentation

2. Recognition

sey. Es scheint nemlich der Wunsch obzuwalten,
Line Segmentation - Deskewing

Before Deskew

After Deskew
Line Segmentation - Deskewing

Top of Page

Bottom of Page
Line Segmentation - Deskewing
Northern Rhodesia is a member of the Federation. Mr. Macleod was not at the weekend meeting. But he told OM B yesterday: "I have no knowledge of secret negotiations." He said Britain had an obligation to consult the Federal Government. Mr. James Callaghan, Labour's Colonial spokesman, said Sir Roy had no right to delay progress in the talks by refusing to sit round the conference table.
Line Segmentation - Multiple Regions
Full Page Recognition

- Two part system: Start of line finder and handwriting recognizer.
- Does not consider rotation or skew.
- Requires start of line training data

Moysset et al., Full-Page Text Recognition: Learning Where to Start and When to Stop.
Full Page Recognition - MDLSTM Attention

- Attention by character or line
- Character level: “the presented system is very slow due to the computation of attention for each character in turn.”
- Line level: Recognition is fast, but assumes lines span entire width.
Proposed Solution

1. Start of line finder
2. Line follower
3. Handwriting Recognition:
   - Es scheint nemlich der Wunsch obzuwalten,
Start of Line Finder

- Fully Convolutional Neural Network
- One prediction for every 16x16 window
- Predicts: X, Y, Rotation, Scale and Confidence
Start of Line Finder - Pretraining
Line Follower

- Recurrent Spatial Transformer CNN
- CNN Regresses the next position (X, Y, Rotation, Scale and Confidence)
- Stops based on confidence or reaching the edge of the page.
Line Follower
Line Follower
Line Follower
Line Follower
Line Follower
Handwriting Recognition

- CNN-LSTM
- CNN Extracts features over a local window
- LSTM processes features over entire length of the handwriting line
Training

50 Images

- Pretrain Start of Line Finder
- Pretrain Line Follower
- Pretrain Handwriting Recognizer

10,000 Images

Initial Alignment (Unsegmented Data)

- Perform Alignment on Training Data

Training (Unsegmented Data)

- Perform Alignment on Training Data
- Train Start of Line Line Finder
- Full Validation on Latest Weights
- Train Line Follower
- Train Handwriting Recognizer
Results: ICDAR 2017 Handwriting Recognition Competition

- 50 Images with line-level segmentations and transcriptions
- 10,000 images with only transcriptions
- We won! (Big thanks to FamilySearch and their line segmentation)
Results: ICDAR 2017 Handwriting Recognition Competition

We Cheated!
(and so did everyone else)
Results: ICDAR 2017 Handwriting Recognition Competition

We Cheated!
(and so did everyone else)
Results: ICDAR 2017 Handwriting Recognition Competition
Results: ICDAR 2017 Handwriting Recognition Competition
Results without “Cheating”: BLEU Score

BONUS:

10,000 images with good line level segmentation data - use to train other algorithms
Thursday, May 9, 1889

Went to Salt Lake to attend a party given at Eldridge's. There was present Kate and Celia Sharp, Katie B. Young, Mel Sharp, Lottie and Georige Webber, Mose Thatcher and girl Walt Jennings, Mr. Teasdale and others. It fell to my lot to take the Webber's home. Stayed at Eldridges that eve.

Thursday, May 9, 1889

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1: Went e Galt Sahe to attend a party gine a Cloridgés. There was present Hatid belia Sharf Halie B. Zang Mel Sharf Lothen Peorgie Webber, Mon Thatcherd'giel Walt, Grnnengs, Mr. Peanalle. And othens 7: Z7 Foll tomy lot to tahe the Webbars homl.
8: Stanged ab Clanedges that eor.
Thank You