# Zhuoyao Zhong

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## Education

2015/09 - present — School of Electronic and Information Engineering, South China University of Technology

**PhD Candidate in Information Engineering** **SCUT-DLVC Lab.** **Supervisor: Prof. Lianwen Jin**

**Research Interests**: Character recognition, Text detection, Layout analysis, Text-centric image understanding

2011/09 - 2015/06 — School of Electronic and Information Engineering, South China University of Technology

**B.Eng. in Electronics and Information Engineering** Outstanding Undergraduate Thesis Award

## Research Experience

**2016/07 – present** **Robust text detection** Key designer & developer
**Mentor: MSRA Researcher Qiang Huo and Lei Sun**

- The first to propose to use Faster R-CNN and Mask R-CNN to address the text detection problem
- Proposed **a novel anchor-free region proposal network (AF-RPN)** that can generate high-quality proposals of various shapes in an anchor-free manner to get rid of hand-crafted anchor design for Faster/Mask R-CNN framework; The idea of anchor-free is also popular in the field of **generic object detection** recently
- Proposed **a novel Relation Network based line grouping approach** to grouping text primitives effectively and detecting text instances with large inter-character spaces robustly
- Proposed **a new region-wise adaptive scaling approach** to detecting small text efficiently on high resolution images (Achieved a competitive F-measure of 77.49% by only processing 896x896 pixels on average for each image on ICDAR-2017 MLT dataset)
- Achieved **state-of-the are results** on horizontal (ICDAR-2013), multi-oriented (ICDAR-2017 MLT, ICDAR-2105 and MSRA-TD500) and curved (Total-text and SCUT-CTW1500) text detection benchmarks
- Deployed in the industry-leading Microsoft's new-generation Printed and Handwritten OCR API in Microsoft Cognitive Services, outperforming Google Vision API significantly on the challenging indoor dataset including 11 scenarios in total (e.g., "document", "receipt", "invoice", "street view", and "product label", etc.)

**2019/03 – present** **Page object detection for document understanding** Key designer & developer
**Mentor: MSRA Researcher Qiang Huo and Lei Sun**

- The first to propose **a unified framework** that can detect both page objects (i.e., text-blocks, formulas, figures and tables) and text-lines within page objects for document understanding scenarios
- Will be deployed in Microsoft's new "ReadDocument" API in Microsoft Cognitive Services

**2014/09 – 2016/07** **Offline handwritten Chinese character recognition** Key designer & developer
**Mentor: Prof. Lianwen Jin**

- The first to propose to incorporate directional features (e.g., Gabor, HoG and gradient features) as domain knowledge into deep convolutional neural network to boost performance on offline HCCR

- Achieved **a new state-of-the-art result** on ICDAR-2013 offline HCCR competition dataset; Source code of our approach has been publicly available on GitHub

## Selected Publications

[1] **Zhuoyao Zhong**, Lei Sun, and Qiang Huo, "A Teacher-Student Learning based Born-Again Training Approach to Improving Scene Text Detection Accuracy", IEEE International Conference on Document Analysis and Recognition (ICDAR), 2019.

[2] Chixiang Ma*, **Zhuoyao Zhong***, Lei Sun, and Qiang Huo, "A Relation Network Based Approach to Curved Text Detection", IEEE International Conference on Document Analysis and Recognition (ICDAR), 2019. (* Equal contribution)

[3] Zhida Huang*, **Zhuoyao Zhong***, Lei Sun, and Qiang Huo, "Mask R-CNN with Pyramid Attention Network for Scene Text Detection", IEEE Winter Conference on Applications of Computer Vision (WACV), 2018. (* Equal contribution)

[4] **Zhuoyao Zhong**, Lei Sun, and Qiang Huo, "An Anchor-Free Region Proposal Network for Faster R-CNN based Text Detection Approaches", International Journal on Document Analysis and Recognition (IJDAR), 2018. (Under review, SCI Journal IF:1.298, arxiv preprint arXiv:1804.09003)

[5] Wei Jia*, **Zhuoyao Zhong***, Lei Sun, and Qiang Huo, "A CNN-based Approach to Detecting Text from Images of Whiteboards and Handwritten Notes", IEEE International Conference on Frontiers in Handwriting Recognition (ICFHR), 2018. (* Equal contribution, oral presentation)

[6] **Zhuoyao Zhong**, Lei Sun, and Qiang Huo, "Improved Localization Accuracy by LocNet for Faster R-CNN based Text Detection in Natural Scene Images", Pattern Recognition, 2017. (Minor revision, SCI Journal, IF:4.582)

[7] **Zhuoyao Zhong**, Lianwen Jin, and Shuangping Huang, "DeepText: A New Approach for Text Proposal Generation and Text Detection in Natural Images", IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2017. (Oral presentation)

[8] Shuangping Huang, **Zhuoyao Zhong**, Lianwen Jin, Shuye, Zhang, and Haobin Wang, "DropRegion Training of Inception Font Network for High-Performance Chinese Font Recognition", Pattern Recognition, 77: 395-411, 2017. (SCI Journal, IF:4.582)

[9] Lianwen Jin, **Zhuoyao Zhong**, Zhao Yang, Weixin, Yang, Zecheng Xie and Jun Sun, "Applications of Deep Learning for Handwritten Chinese Character Recognition: A Review", Acta Automatica Sinica, 2016, 42(8): 1125-1141.

[10] **Zhuoyao Zhong**, Lianwen Jin, and Zecheng Xie, "High Performance Offline Handwritten Chinese Character Recognition Using GoogLeNet and Directional Feature Maps", IEEE International Conference on Document Analysis and Recognition (ICDAR), 2015. (Oral presentation)

## Skills

- Programming languages: **C/C++, Python, matlab**
- Deep learning toolboxes: **Caffe, Caffe2, PyTorch**
- Good ability of reading and writing in English

## Selected Awards and Honors

- Co-contributor of Microsoft's new-generation Printed and Handwritten OCR API, 2018
- IEEE ICDAR 2017 Travel Awards, 2017
- "JianZhong Cai" Scholarship, SCUT, 2015 ~ 2017
- Outstanding Undergraduate Thesis Award, SCUT, 2015
- Outstanding Project of National College Students' Innovative Plan, SCUT, 2014