2018 Internship Project & Abstract - Chuanbo Wang

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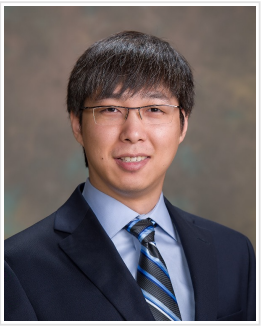
Assisting the Visually Impaired: Sign Detection and Recognition Using Deep Learning



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Background: Approximately 7 million people are blind and visually impaired in the US. Traditional feature-based approaches have been utilized in prior research for sign recognition and indoor environment navigation. Although great success is achieved when applying deep learning algorithms to computer vision problems, relatively few deep learning-based solutions are devised to recognize indoor signs. The objective of this project was to increase the quality of life for people who are visually impaired by developing a deep learning based indoor sign detection and recognition system.

Methods: A dataset containing 776 images from approximately 250 indoor signs within the Marshfield Medical Center was created. 582 images were randomly selected for training a model and the remaining 194 images were used for testing. Images were annotated with locations for all signs and symbols for detection and we created text ground truth for character recognition purpose. Our recognition system pipeline consisted of three major steps: 1) a convolution neural network model was trained to detect signs and symbols; 2) after preprocessing, optical character recognition (OCR) software was used to recognize text on the signs within the detected regions; and 3) an existing text-matching algorithm was used to correct recognized text based on a vocabulary database we constructed for this project.

Results: The sign detection had 96% precision and 94% recall. The end-to-end recognition system yields 91% precision and 53% recall.

Conclusions: The experience from this project yields further insights on the generalizability and applicability of integrating deep-learning approaches and OCR software to aid the visually impaired in recognizing indoor signs. The system will not perform the same in other hospitals without transfer learning or retraining. Future work will focus on the generalizing the system.