2017 Internship Project & Abstract - Fereshteh Bashiri

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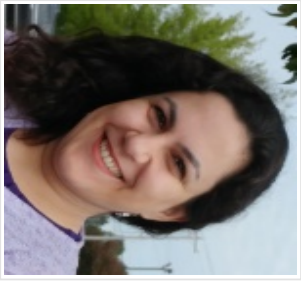
MCIndoor: A Computer Vision Framework To Assist Navigation of Visually-impaired People



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Research area: Biomedical Informatics

Background: Blindness or vision impairment is one of the top ten disabilities, affecting more than 3.4 million (3%) Americans age 40 years and older. Accessibility of visual information is of paramount importance to increase safety and independence of these people, particularly in unfamiliar environments. This project focused on developing machine learning algorithms to assist their mobility in clinics, hospitals and urgent care centers.

Methods: Delivering sight to blind and visually-impaired people is an intimidating task without the help of machine intelligence systems that can efficiently turn objects into sights. We utilized a deep convolutional neural network (CNN), namely “AlexNet” trained with a dataset of 2076 images collected from Marshfield Clinic in Marshfield to detect remarkable indoor landmarks (e.g., doors, stairs and hospital signs). The CNN is utilized by two different strategies: (1) Transfer Learning (TL), and (2) Feature Extraction (FEx). The TL approach preserves the network architecture and transfers learned features of a pre-trained network to the new problem, while the FEx approach treats pre-trained network as a feature extractor and uses a linear classifier to classify the new dataset. To speed up the training process and make a real-time decision, we have employed NVIDIA GPU Quadro M5000.

Results: The CNN is trained with TL and FEx approaches using 25% of total collected images, with the training time of 5787 and 170 seconds respectively. On average, the accuracy of recognizing indoor landmarks is 94.6% and 99.2%.

Conclusions: The accuracy, time efficiency, and the robustness of our proposed framework were promising. The framework has the potential to recognize a variety of objects in the indoor environment, and ultimately to help visually-impaired people navigate their way in the clinic independently.