Degree (Doctoral thesis abstract)

This thesis presents deep neural network-based methods for online handwriting recognition, text-independent writer identification, and pixel-level text segmentation. For online handwriting recognition, there are several challenges, such as a huge character set with limited sample per character (Japanese) and delayed strokes caused by diacritical marks (Vietnamese). Multiple transformations are applied to increase number of training patterns as well as decrease the imbalance of database. Besides, different point-based features, as well as shape context features, are considered together with various network structures. The proposed methods achieve high accuracy on both Japanese and Vietnamese online handwritten text. For text-independent writer identification, the training patterns are shuffled and grouped randomly during training stage, which performs well on both isolated Japanese handwritten characters and English handwritten text pages. This proposed training scheme helps eliminate the dependence on text of deep neural networks. Consequently, the experiments on online handwriting patterns using the same training scheme are conducted but the results are lower than the offline handwriting patterns, especially when the number of writers increases. The last topic is to segment text pixels from historical document images with various deformations such as faded, show-through, noises, non-unique background, fragments and so on. This is a necessary stage to eliminate noises and background before applying handwriting recognizer. The proposed deep neural network with a small number of convolutional layers using limited and imperfect training patterns is able to segment the text pixels from other background and noise pixels. Although these three problems are related to different aspects of document analysis and recognition field, deep neural network with appropriate feature extraction and training scheme could partially solve them. In general, this thesis provides details on how to design and train a deep neural network effectively for a specific problem.