Abstract

Parametric image classification methods are usually complex because they require intensive training. Therefore, non-parametric Nearest Neighbour (NN) classifiers are preferred in many cases. Naive Bayes Nearest Neighbour (NBNN) and its modified version, local NBNN, are recently proposed classifiers that present decent performance with reduced complexity. They compute image-to-class (I2C) distance instead of image-to-image (I2I) distance. As a result, local image features will not be quantised and the effectiveness of classifiers thereby stays in a relatively good level. In this thesis, NBNN and local NBNN are further improved. With the idea of fully taking advantage of contextual information, we use saliency detectors to classify local features of reference images into foreground and background. We base our I2C distance computation on foreground and background separately. The suggestions from these distances can make label estimation more reliable. Though the times of I2C distance computation have been increased for each query image, we accelerate our classification procedure based on the evidence that the performances of NBNN and local NBNN are hardly affected when enough anchor points, which are produced by clustering, are put into use to replace the large number of referring features in each class. On the basis of the novel works stated above, the proposed context-aware methods outperform NBNN or local NBNN in both accuracy and efficiency. The comparisons have been made on three databases: Pami-09, Caltech-5, and 15-Scene.

Acknowledgments

First of all, I would like to give my sincerest thanks to Prof. Ling Shao and Prof. Alejandro Frangi, who have kindly offered me suggestions on both research topics and personal development. Prof. Shao gave me the opportunity to study in Sheffield, and helped me settle in. Without his guidance and encouragement, I could not have had two journal papers published in two years. After Prof. Shao moved to Northumbria, I determined to stay in Sheffield and Prof. Frangi became my supervisor. I want to thank Prof. Frangi for his support in every decision that I have made since.

My thanks as well go to Dr. Ali Gooya and Dr. Karim Lekadir, whom I used to work closely with. They put huge effort in identifying the problems that I faced and contributed a lot to the drafting and revision of my second paper. I also want to thank Dr. Luke Seed, who has always been willing to hear my opinions and research progress as one of the mentors.

I would like to thank all my group colleagues: Dr. Simon Jones, Dr. Ruomei Yan, Dr. Di Wu, Dr. Liu Li, Dr. Fan Zhu, Zheng Feng, Bo Dong, Redzuan Bin Abdul Manap, Mengyang Yu, Ziyun Cai, Dr. Susheel Varma, Rui Hua, Vignesh Rammohan, Isaac Castro Mateos, Edward Cramphorn, Idayat Salako, Hamid Fehri, and Le Zhang.

I also want to thank my friends David Fan, Xiao Zhang, and Raven Wang, you guys make my life here unforgettable.

Last but not least, I want to thank my parents for their unreserved support in the past 26 years of my life.

Contents

Publication

Peng, P., Shao, L., Han, J., & Han, J. (2015). Saliency-aware image-to-class distances for image classification. *Neurocomputing*, *166*, 337-345.

List of Figures

List of Tables