Heterogeneous Ensemble for Imaginary Scene Classification

Saleh Alyahyan Supervisors: Dr. Wenjia Wang & Dr. Tony Bagnall

Abstract:

In data mining, identifying the best individual technique to achieve very reliable and accurate classification has always been considered as an important but non-trivial task. This paper presents a novel approach heterogeneous ensemble technique, to avoid the task and also to increase the accuracy of classification. It combines the models that are generated by using methodologically different learning algorithms and selected with different rules of utilizing both accuracy of individual modules and also diversity among the models. The key strategy is to select the most accurate model among all the generated models as the core model, and then select a number of models that are more diverse from the most accurate model to build the heterogeneous ensemble. The framework of the proposed approach has been implemented and tested on a real-world data to classify imaginary scenes. The results show our approach outperforms other the state of the art methods, including Bayesian network, SVM and AdaBoost.
Time-Series Classification with COTE: The Collective of Transformation-Based Ensembles

Anthony Bagnall, Jason Lines and Aaron Bostrom

{anthony.bagnall, j.lines, a.bostrom}@uea.ac.uk

Recently, two ideas have been explored that lead to more accurate algorithms for time-series classification (TSC). First, it has been shown that the simplest way to gain improvement on TSC problems is to transform into an alternative data space where discriminatory features are more easily detected. Second, it was demonstrated that with a single data representation, improved accuracy can be achieved through simple ensemble schemes. We combine these two principles to test the hypothesis that forming a collective of ensembles of classifiers on different data transformations improves the accuracy of time-series classification. The collective contains classifiers constructed in the time, frequency, change, and shapelet transformation domains. For the time domain, we use a set of elastic distance measures. For the other domains, we use a range of standard classifiers. Through extensive experimentation on 72 datasets, including all of the 46 UCR datasets, we demonstrate that the simple collective formed by including all classifiers in one ensemble is significantly more accurate than any of its components and any other previously published TSC algorithm. We investigate alternative hierarchical collective structures and demonstrate the utility of the approach on a new problem involving classifying Caenorhabditis elegans mutant types.
Visual Navigation System for People with Sight Loss

Renato Busatto, Dr. Richard Harvey and Dr. Mark Fisher

Speech, Language and Audio Processing Laboratory
{r.busatto-figueiredo, r.w.harvey, mark.fisher}@uea.ac.uk

According to the 2013 census, there are over 1.8 million people in the United Kingdom whose visual impairment is significant enough to cause impact on their daily lives [1]. The difficulty in making simple journeys can result in blind and partially sighted people being confined at home and can lead to isolation, reduced wellbeing and low self-esteem [1].

Although there have been several devices designed to help visually impaired people to navigate outdoors, the development of accurate and friendly Navigation Assistance for Visually Impaired (NAVI) systems have not become a reality yet. The systems currently available on the market are based mainly on the GPS data, which is not accurate enough to guide a person with no sight [2]. On other hand, outdoor NAVI systems with improved accuracy are based on RFID, ultrasonic sensors, heavy image processing and/or RGB-D cameras [2], leading to expensive equipment that require the user to bear heavy and inconvenient accessories.

Parallel to the development of NAVI systems is the miniaturization of wearable devices. In 2012, Google announced the Project Glass, which main goal has been to build a friendly wearable computer that records a person’s perspective of the world and delivers information through a head-up display (Figure 1).

Now we see the emergence of a new field of research in computer vision, focused on the user’s point of view. Noticeably, FPCV is somehow more specific than simple vision from moving cameras, due to the constraints the device has with the subject and his sub-parts. One of problem addressed in the FPCV field is the photo geolocation. Is it possible to determine the GPS coordinates from where a photo was taken based solely on its pixels? On the on-line game GeoGuessr (geoguessr.com) the player receives an image and guess where around the world such image was taken. This is an extremely challenging task to humans and a difficult high level computer vision problem (Figure 2).

Based on these considerations, we define the research field as the development of an accurate and robust navigation system based on street view recognition to improve independence of people with impaired sight. We propose a improvement to the multiple nearest neighbour feature matching method presented by Zamir & Shah [3] by pre-processing the images to make them invariant to luminance [4]. The results obtained so far identified the variation in luminance and viewpoint as critical to the performance of NAVI systems.

References
Polynomial Maximum Ignorance Colour Correction

Fufu Fang and Professor Graham Finlayson

Colour Laboratory
{F.Fang, G.Finlayson}@uea.ac.uk

The RGB responses produced by a digital camera is device dependent, i.e. different cameras produce different RGB values for the same colour signal. Transformation from device dependent colour spaces to a device independent colour space (e.g. CIE XYZ) is common to almost all colour reproduction pipelines. The process of this transformation is commonly called colour correction. This process is vital for the faithful reproduction of colours. Linear regression of polynomial least squares regression can be used to estimate the transfer matrices between RGB and XYZ (which result in $3 \times 3$ matrices [1] and $3 \times n$ matrices respectively [2]). The regression is performed between the measured RGB values from the camera, and the XYZ values of the a sample scene. Maximum Ignorance with Positivity colour correction is a method for calibrating the colour correction matrix for RGB camera using the only the spectral response function of the imaging sensor [3]. In this method, we are maximally ignorant about the world. The only assumption we make is that the light signal that reaches the camera is positive in power. This assumption is theoretically justifiable as spectra with negative power cannot physically occur.

In this poster, we explore the mathematical theory behind the algorithm, and evaluate its performance.

References


Survival benefit of statins in the general population

Lisanne A Gitsels
Supervisors: Elena Kulinskaya, Nicholas Steel, Nigel Wright

School of Computing Sciences, University of East Anglia
l.gitsels@uea.ac.uk

Objective  The aim was to estimate the survival benefit from statins prescribed as primary prevention of cardiovascular disease for different risk groups at various ages in the general population.

Methods  This population-based cohort study made use of data from the UK THIN primary care database; medical records from 1987-2011 of people born between 1920-1940. Four cohorts aged 60, 65, 70, or 75 years with no history of cardiovascular disease included 118,700, 199,574, 247,149, and 194,085 participants, respectively. Participants were grouped by QRISK2 baseline risk of a first cardiac event in the next ten years of <10%, 10-19%, or ≥20%. The hazard of all-cause mortality associated with statins prescriptions was calculated by a Cox’s proportional hazard regression, adjusted for covariates including sex, year of birth, socioeconomic status, diabetes, blood-pressure regulating drugs, high cholesterol, body mass index, smoking status, and general practice.

Results  There was no survival benefit associated with statins prescriptions in people at <10% risk of a first cardiac event at any age or in people younger than 60 at any cardiac risk. There was potential survival benefit associated with statins prescriptions in people at 10-19% cardiac risk at ages 70 and 75. There was certain survival benefit associated with statins prescriptions in people at ≥20% cardiac risk at ages 65, 70, and 75, translating to an increase in life of 1.5, 1.9, and 2.0 years.

Discussion  The current recommended thresholds for statins therapy for primary prevention of cardiovascular disease in routine practice may be too low and may lead to overtreatment, particularly in people with <10% cardiac risk or younger than 60 years old.
Visual Prosody in Speech Animation

David Greenwood and Dr. Stephen Laycock

Graphics Laboratory
{david.greenwood, s.laycock}@uea.ac.uk

Speech animation involves transforming and deforming a character model, temporally synchronised to an audible utterance to give the appearance that the model is speaking. Given the close relationship between speech and gesture[1], the problem is challenging, as human viewers are very sensitive to natural human movement [2]. Practical applications of speech animation, for example computer games and animated films, often rely on motion capture devices or hand keyed animation [3]. Demand for highly realistic animation within these domains is significant and both of these approaches are expensive and time consuming, providing considerable motivation for automation of the process.

Speaker head motion is an interesting aspect of visual speech. Head motion has been shown to contribute to speech comprehension [4] yet unlike the articulators, it is under independent control. As the audio channel contains the most complete information stream during discourse, it is a reasonable strategy to use features within this stream to enable convincing predictions of head pose.

We collect multi-modal data using synchronised cameras and extract suitable audio features. By posing the task as a hybrid translation and sequence to sequence learning problem [5, 6], we train deep Bi-Directional Long Short Term Memory (BLSTM) neural networks capable of learning long-term structure in language and kinematics. We demonstrate the effectiveness of our predictions by applying our synthetic motion to a 3D mesh extracted from our training data.

Figure 1: Multi-modal data is collected using synchronised cameras.

References
POP Image Fusion - Derivative Domain Image Fusion Without Reintegration

Graham D. Finlayson and Alex E. Hayes

Colour Lab
{g.finlayson, alex.hayes}@uea.ac.uk

There are many applications where multiple images are fused to form a single summary greyscale or colour output, including computational photography (e.g. RGB-NIR), diffusion tensor imaging (medical), and remote sensing. Often, and intuitively, image fusion is carried out in the derivative domain. Here, a new composite fused derivative is found that best accounts for the detail across all images and then the resulting gradient field is reintegrated. However, the reintegration step generally hallucinates new detail (not appearing in any of the input image bands) including halo and bending artifacts. In this paper we avoid these hallucinated details by avoiding the reintegration step.

Our work builds directly on the work of Socolinsky and Wolff\cite{Socolinsky2004} who derive their equivalent gradient field from the per-pixel Di Zenzo structure tensor which is defined as the inner product of the image Jacobian. We show that the x- and y-derivatives of the projection of the original image onto the Principal characteristic vector of the Outer Product (POP) of the Jacobian generates the same equivalent gradient field. In so doing, we have derived a fused image that has the derivative structure we seek. Of course, this projection will be meaningful only where the Jacobian has non-zero derivatives, so we diffuse the projection directions using a bilateral filter before we calculate the fused image. The resulting POP fused image has maximal fused detail but avoids hallucinated artifacts. Experiments demonstrate our method delivers state of the art image fusion performance.

This research was presented at ICCV 2015\cite{Finlayson2015}.

Figure 1: RGB-NIR Image Fusion: original RGB and near-infrared input images\cite{Rance2015}, Spectral Edge\cite{Rance2015}, Eynard et al.\cite{Eynard2015} and POP results (detail, top-left: RGB, top-right: SE, bottom-left: Eynard et al., bottom-right: POP). The POP result has superior contrast and detail compared to the other methods. The SE result is natural and adds extra detail, while the result of Eynard et al. transfers NIR detail effectively, but suffers from a green color cast.
Management Challenges for DevOps Adoption within UK SMEs

Stephen Jones, Fiona Lettice and Joost Noppen

Innovation, Technology and Operations Management (NBS) / Software Engineering (CMP)
{stephen.j.jones,fiona.lettice,j.noppen}@uea.ac.uk

The DevOps phenomenon is gathering pace as more UK organisations seek to leverage the benefits it can potentially bring to software engineering functions. However substantial organisational change is inherent to adopting DevOps, especially where there are prior and established methods. As part of a wider piece of doctoral research investigating the management challenges of DevOps adoption, we present early findings of a one year qualitative diary study following the adoption of DevOps within two UK based SMEs. We find that within our case study organisations, the DevOps approach is being adopted for the development of a new system used both internally and by customers. DevOps, conceptually, appears to be generally well regarded, but in reality is proving difficult to fully adopt. This difficulty is down to a combination of necessity in maintaining a legacy system, changes in development approach, managerial structure and resistance. Additionally, we are finding evidence of job crafting, especially with the software developers. Taken together, we put forward the argument that DevOps is an interdisciplinary topic which would greatly benefit from further management and potentially psychology oriented research attention.

Bibliography
