Adaptive Fusion for Face Recognition in Video Surveillance

Program: Ph.D. in Engineering

Funding: Financial support is available for the project's duration (maximum of 4 years).

Start date: Summer or autumn of 2012

Project description:

The rapid and covert recognition of individuals of interest from video streams collected over distributed video surveillance networks remains a challenging problem, especially in dense and moving crowds. In practice, the performance of state-of-the-art systems applied to video-based face recognition typically declines because of the complex environments that change during operations. In addition, faces captured in video streams are matched against the facial model of individuals, each one designed a priori using a limited number of reference samples collected during enrollment. Systems for face recognition in video surveillance can exploit spatio-temporal information and learn new reference video streams to sustain a high level of performance.

The main objective of this research project is to investigate adaptive and robust multi-classifier systems (MCSs) for face recognition in video surveillance. These techniques should allow to achieve a high level of accuracy in real-world applications, and to efficiently update facial models in response to new reference streams. Given a MCS that assigns a diversified pool of 2-class classifiers per individual, new reference data allows to adapt these classifiers through Particle Swarm Optimization (PSO)-based evolutionary optimization.

In this project, a PhD candidate will focus on incremental Boolean combination (BC) techniques required to adaptively manage and select classifiers for fusion according to properties of PSO search and objective spaces. Incremental BC is also required to update fusion functions over time, in response to new or changing pools of classifiers. Face recognition in video surveillance corresponds to an open-set problem, and only a very small proportion of the faces captured during operations correspond to an individual of interest. To account for the limited and skewed data collected in real-world environments, new techniques will be developed for unbiased BC of classifiers in the Cost Curve decision space. This may provide a more accurate selection and fusion of classifiers ensembles for a given level of data skew and misclassification costs. To accelerate all phases of this project, new techniques will be validated using real video streams on high-speed GPGPU platforms, and performance will be compared against commercial and academic systems.

This project will take place at the Laboratoire d'imagerie, de vision et d'intelligence artificielle (LIVIA), École de technologie supérieure, Montreal, Canada, under the supervision of Professors Eric Granger, Robert Sabourin and Guillaume-Alexandre Bilodeau. Research will be performed in partnership with Laboratoire d'Interprétation et de Traitement d'Images et Vidéo (LITIV), École Polytechnique de Montréal, and the Dr. Gorodnichy of the Video Surveillance and Biometrics Technologies Section, Applied R&D, Canada Border Services Agency. Financial backing for this project has been provided by the *Fonds de recherche sur la nature et les technologies Québec (FRQ-NT).*

Expertise:

PhD candidates for this project should have earned a Master's degree in Electrical, Computer or Software Engineering, in Computer Science or in related areas. They should also have a background in one or more of the following disciplines: biometrics, face recognition, image/video processing, video surveillance, computer vision, machine learning, pattern recognition, multi-classifier systems.

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