Digital Twin of Urban Crowd

Supervisor: *Victor Sanchez (CS)*

Co-supervisors: Tanaya Guha (CS) , Theo Damoulas(CS/Stats)

Background: A digital twin is a virtual model of a process, product or service. This pairing of the virtual and physical worlds allows analysis of data and monitoring of systems to head off problems before they even occur, prevent downtime, develop new opportunities and even plan for the future by using simulations. Measuring urban mobility in terms of crowd and traffic density has many applications, such as developing early warning systems for disease outbreak, designing efficient traffic management systems, and informing local interventions for economic recovery in the post-covid era.

The project: The primary goal of this MSc project is to utilize a single traffic camera feed to develop an end-to-end deep network that estimates a quantitative measure of the crowd and traffic density in a given scene in (near) real-time. Regular object detection techniques do not perform very well in crowded scenes. Hence, the challenge of the project lies in modeling the crowd/traffic density without the explicit use of detection. One approach could be to use Gaussian processes within the deep model [1]. The project will use camera footage made available to us by TfL [2].

Deliverable: A deep learning model for estimating crowd and traffic density in (near) real time from a single, fixed camera feed. Weakly-supervised and transfer learning paradigms are the most suitable here as exact labels are not available.

Desirable skills: Python, Machine Learning

Opportunities for a PhD: The mini project can be extended in many ways for a PhD: (i) predict or forecast density instead of estimation, (ii) extend the estimation/forecasting technique to a network of camera feed by jointly estimating density at all network nodes. The student has the opportunity to join an existing team of researchers at Warwick and the Alan Turing Institute.

Reference:

[1] Sindagi et al. ECCV 2020: https://arxiv.org/pdf/2007.03195.pdf (GP based crowd density estimation from images)

[2] Our ongoing video analysis work on the TfL footage: https://arxiv.org/abs/2012.07751