

COMPUTATIONAL INTELLIGENCE TO IMPROVE AIR QUALITY AND TRAFFIC MANAGEMENT

Computational Intelligence (CI) techniques are strong and efficient and capable of enhancing current traffic and air quality management systems.

The challenge

Many cities face challenges with congestion and its associated impacts on air quality. Innovative solutions are required in order to overcome these challenges.

Implications

CI techniques, such as Artificial Neural Networks (ANN) and Evolutionary Computing (EC), enable systems to learn, adapt, and optimise even without any a-priori knowledge of the underlying system. Applying CI to the challenge of traffic congestion and its related impacts on air quality has substantial benefits. Rather than using a traditional reactive approach to traffic management, CI can predict and thus deliver solutions to most complex situations before they happen. Figure 1 shows ANN forecasted pollution

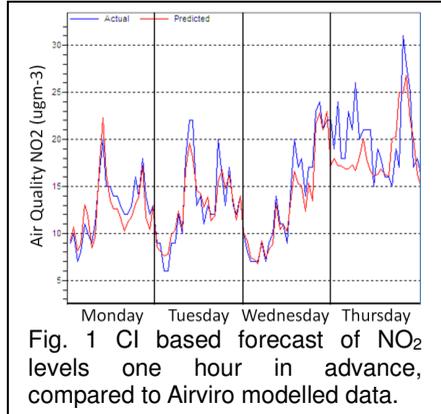


Fig. 1 CI based forecast of NO₂ levels one hour in advance, compared to Airviro modelled data.

levels one hour in advance to the Airviro modelled data. Predicted traffic and air quality values are then used by an EC algorithm to deliver optimised traffic management strategies.

Improvements in traffic congestion will have large benefits on quality of life and the economy through reduced time and fuel consumption. In addition, reduced fuel consumption also lowers its related emissions of carbon dioxide and other pollutants. The related improvements in air quality will impact the health related problems such as respiratory problems which will be beneficial from a societal perspective, but also from a health expenditure perspective. The environmental benefits of improving traffic flow and its associated emissions are also substantial.

“Computational Intelligence powered systems such as iTRAQ may well solve some of our most urgent problems we are facing in ITS”

Steve Dibnah, THE ISSUE Project, Leicester City Council

Societal Challenge: Innovations in ITS User Application: Traffic Management

The political benefits of this come from working towards meeting the European targets for air quality and transport related carbon emissions. The regional transport policies of THE ISSUE partner regions all indicate a need for improvements in congestion and its associated effects on air quality.

Priorities for the partner regions include:

- Optimisation of existing networks
- Reduction of transport emissions
- Reducing impact of transport induced air and carbon emissions on health
- Improvement of the air quality

Applying computational intelligence to congestion and air quality management will work towards meeting the regional and overall European priorities for mobility and air quality.

THE ISSUE solution

The use of CI in traffic management has been explored using the THE-ISSUE's triple helix approach. A consortium of universities, authorities, and a commercial prime has been formed to study and eventually exploit an Integrated Traffic Management and Air Quality Control System - iTRAQ.

A European Space Agency funded feasibility study was conducted in which the operational and commercial feasibility of this novel technology was demonstrated.

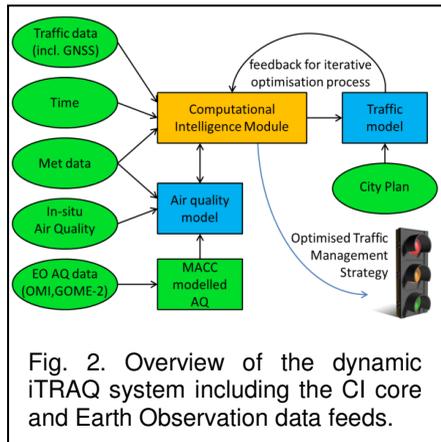


Fig. 2. Overview of the dynamic iTRAQ system including the CI core and Earth Observation data feeds.

A prototype was implemented, shown to be capable of fusing existing data sources, forecasting traffic and air quality, and delivering solutions to emerging congestion problems before they formed (Fig. 2).

The project is currently in the process of being brought to market, delivering a fully integrated traffic management and air quality control system to users.

Outlook to the future

CI provides advanced techniques that can solve a wide variety of problems. The next years will bring new "Big Data" based systems that combine existing data sets to provide better and completely new services such as personalised integrated multi-modal travel planners. CI will often be at the core of such advanced new systems.

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