Modern metro transportation is typically seen as a means to foster density, reduce reliance on cars, mitigate sprawl, and provide residents with access to affordable transportation. Central to delivering Intelligent Metro Transportation Solutions is a multi-technological architecture capable of supporting the metro transportation operation and engineering maintenance. From **Operational aspect**, through a sophisticated state-space-time network, we can easily solve train (re)scheduling and locomotive planning simultaneously. With a state-of-the-art, Multi-View Multi-Scale Fusion (MVMS), we are able to count crowd size on large and wide areas (like train platforms) with multi-cameras so that can detect over-crowding, long queueing times. In addition, based on percolation theory, a data-driven framework is developed to quantitatively study the dynamic evolution of metro network connectivity (friendliness) and detect recurrent bottlenecks with an individual perspective being involved. From **engineering aspect** an image-based detection framework based on deep learning principles for automatic inspection of rail tracks is proposed. All those technologies will mobilize intelligence and deliver real-time situational awareness across stations, lines, trains and operational control centres. The reliability, safety and security of passenger travel will be guaranteed while reaching new heights of service, productivity, and profitability.

**Summary**

We developed a novel method for assigning trains to locomotives, determining a route for each locomotive, and determining a timetable for each train, so that the total cost is minimized. Constraints of different types need to be satisfied. Three types of conflicts, which violate track capacity constraints, are shown below in a state-space-time network, where states indicate whether locomotives are light running or serving trains.

**Wide-Area crowd counting with MVMS**

We developed a deep learning method for counting crowd size in large and wide areas (like train platforms) with multi-cameras. We first predict a ground-plane density map from multi-camera frames. Then the count is the sum of the density map.

**Bottleneck identification of metro network**

Based on percolation theory, a data-driven framework is developed to characterize the dynamic process as “transit percolation”, and present how global transit breaks down when bottleneck links are congested from the perspective of passengers’ cognition.

**Integrated train timetabling and locomotive assignment**

We developed a novel method for assigning trains to locomotives, determining a route for each locomotive, and determining a timetable for each train, so that the total cost is minimized. Constraints of different types need to be satisfied. Three types of conflicts, which violate track capacity constraints, are shown below in a state-space-time network, where states indicate whether locomotives are light running or serving trains.

**An image-based identification of rail track**

Based on rail images, the proposed framework based on deep learning principles realizes accurate rail track inspection.