Taxi-speed Prediction by Spatio-Temporal Graph-based Trajectory Representation and Its Applications

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Abstract— Airport surface movement systems require aircraft taxing speed as a key input to perform ground movement optimization and path planning processes. With the increasing availability of surface movement data from systems such as A-SMGCS, a data-driven framework using a spatio-temporal graph-based trajectory representation is proposed in this paper to predict aircraft taxing speed. The proposed framework includes a data preparation module for converting track points data to graph-based representation and a developing predictive model module for learning taxi-speed model. The Random Forest algorithm is selected as our predictive model. The model predicts the aircraft taxi-speed with an error of ±1.08 m/s for taxi-out procedure and ±0.97 m/s for taxi-in procedure, when compared with the actual taxi-speed from A-SMGCS data, respectively. Further, three applications of our approach are discussed which are taxi-speed profile, unimpeded taxi time and potential conflict detection. The results of our methods outperform all baseline methods. In detail, for generating taxi-speed profile, our method obtains the error ±1.38 m/s while for computing unimpeded taxi time, our method outperforms the baseline model with the mean absolute percentage error is 11.03% for the taxi-in and 16.8% for taxi-out procedure, respectively.