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Machine Learning Application in Air Traffic Management Resiliency based on Capacity Regulations

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Abstract—There is a considerable interest in air transportation resilience as a mechanism for coping with the consequences of disruptions to local authorities. Although the identification of metrics and baselines for measuring resilience are still regarded as challenges, we believe that the meaning of disruptions is no longer driven solely by safety threats but also by emergent performance issues. In this paper, resilience of the European Air Traffic Management Network (EATMN) is studied from a performance perspective. In fact, improved predictability and reliability of planning data across the EATMN, allow reduction of reserved Air Traffic Management (ATM) capacity. Consequently, the management of emergent demand-capacity imbalances, regarded as disruptions, is added to tactical phase of air traffic flow and capacity management (ATFCM). In this phase of operations (i.e. day of operations) a limited number of variables are available to form aggregated indicators for network resilience. We consider that available data about ATFCM regulations reveal restorative mechanisms for tactical demand-capacity balancing (DCB). Aggregated indicators are regarded as enablers to monitor the resilient management of Area Control Centers and to observe spatial distribution of network resiliency. This paper presents an exploratory effort of the needed situational awareness by exploring supervised learning techniques in the context of ATFCM regulations. In particular, it focuses on the application of machine learning algorithms and comparison of different architecture variants to a regression study on tactical DCB disruptions.

Keywords—Network Resilience, ATFCM regulations, Emergent disruptions, Machine Learning, Neural networks, Supervised Learning