The Hybrid AI-Human Air Traffic Management

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What Makes this Possible?
Preparing Air Transportation for Industry 4.0
ATM Research Community Explores AI

Research Publications
Google Scholar (Key word: Air Traffic Management + Artificial Intelligence)

2020: Over 1000 research papers published in AI applied to ATM
Why Machine Learning Approach?

Classical CD&R Models

• Level Change
• Speed control
• Vectoring
• Direct-To

Conflict Scenario

Separation Standards
Horz. Sep < 5 nm & Vert. Sep < 1000 ft

Data

Conflict?
Yes

Rules

Actions

Conflict Scenario

Unseen Conflict Scenario

Data

Machine Learning Models

Actions

Rules

Update Belief

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Why Machine Learning Approach?
The Hybrid AI-Human ATM Approach

Combine the Expert Judgement with Relevant Data

- Extract human actions (intelligence) from data.
- Convert data into patterns and generalizations.
- Use these patterns to predict actions.
- Update patterns based on human actions.
Nam Tran, DucThinh Pham, Sameer Alam, Vu Duong (2020), Taxi-speed Prediction by Spatio-Temporal Graph-based Trajectory Representation and Its Applications. 9th Intl. Conference on Research in Air Transportation (ICRAT 2020), Florida, USA
Agent learns arrival pattern, wake separation, runway occupancy time to predict the inter-arrival gaps and push departure with indicated confidence level.

Li Long, Thinh Pham and Sameer Alam, Deep reinforcement learning approach for real-time departure slotting in mixed mode runway operation (2020), 30th International Joint Conference on Artificial Intelligence (under review), Montreal, Canada.

Van Phat, Sameer Alam, Nimrod Lilith, Phu Tran (2021) A Convolutional Neural Network Approach for Object Detection in Airport Airside Environments, IEEE ICME, China (under review)

T.N.M Nadirshah & Sameer Alam Master's Thesis 2020, Predictive Analytics using AI Assistance & Spatial Augmented Reality for Singapore Changi Airport. NTU Singapore
Open Research Challenges

- Trust of ATC in AI/ML system
- Integration issues with ATM system
- Safety Verification and Validation
- Post accident audit mechanism

Questions or Feedback:
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