Internship position : Predictive Aircraft Maneuver Dynamics

Key words : **State Prediction, Forecasting, Data-Driven**

Department: **DISC/DCAS**

JOB DESCRIPTION:

The objective of this internship is to study state-of-the-art approaches and design a solution to predict an aircraft future possible trajectories.
The prediction leverages on the aircraft actual (simulated) flight dynamics and control inputs.

The predictive algorithm generates a stochastic model of the aircraft trajectory, quantifying uncertainty through a time-varying probability distribution.

Rather than providing a single deterministic path, the model estimates a confidence interval for the state variables, where the variance and the degree of uncertainty, increases as a function of the prediction horizon.

In Figure 1 is represented a basic example of the trajectory uncertainty envelope.

Finally, the algorithm is evaluated based on, in order:

(1) Non-violation of the confidence region;

(2) Prediction quality and confidence region minimization;

(3) Execution time.

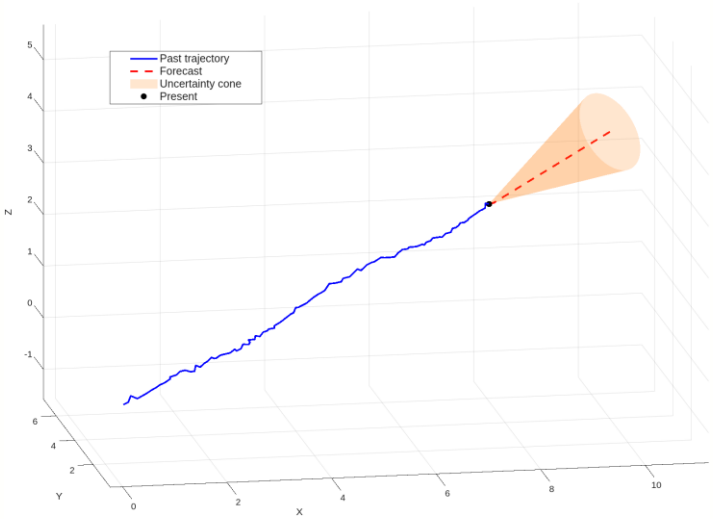


Figure 1: 3D Trajectory with Uncertainty.

MISSIONS:

- Investigate aircraft maneuvers profiles and implement them within a MATLAB-based flight simulation framework to generate a high-quality dataset.
- Review literature on nonlinear model identification methods **[1][2]**, black-box prediction methods **[3][4][5]** and hybrid of the two methods **[6][7]** for real-time applications.
- Prototype algorithm(s) considering execution time constraints.
- Quantify prediction confidence with respect to maneuvers predictability and effects of measured environmental conditions.

REQUIRED PROFILE:

Pursuing a Masters in Aerospace Engineering, Computer Science, Control Engineering, Mathematics, Electronics Engineering, or a related field with a focus on AI and Robotics.

Strong Understanding of:

- Linear algebra, probability theory, calculus.
- State estimation theory and techniques.
- Optimization theory and techniques.
- Model identification fundamentals.
- Machine learning, reinforcement learning and deep learning fundamentals.

Preferred Skills and Interests:

- Hands-on project(s) based on optimization or machine learning or reinforcement learning or deep learning (preferably in Python/MATLAB). **[8]**
- Probabilistic forecasting and uncertainty modeling.
- Digital signal processing and time-domain analysis.
- Aircraft maneuvers.

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DURATION: 4-6 MONTHS

LOCATION: TOULOUSE

RESPONSIBLE OF THE SUBJECT:

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APPLICATION PROCESS:

Applications must be sent to :
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— joel.bordeneuve-guibe@isae-supaero.fr

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