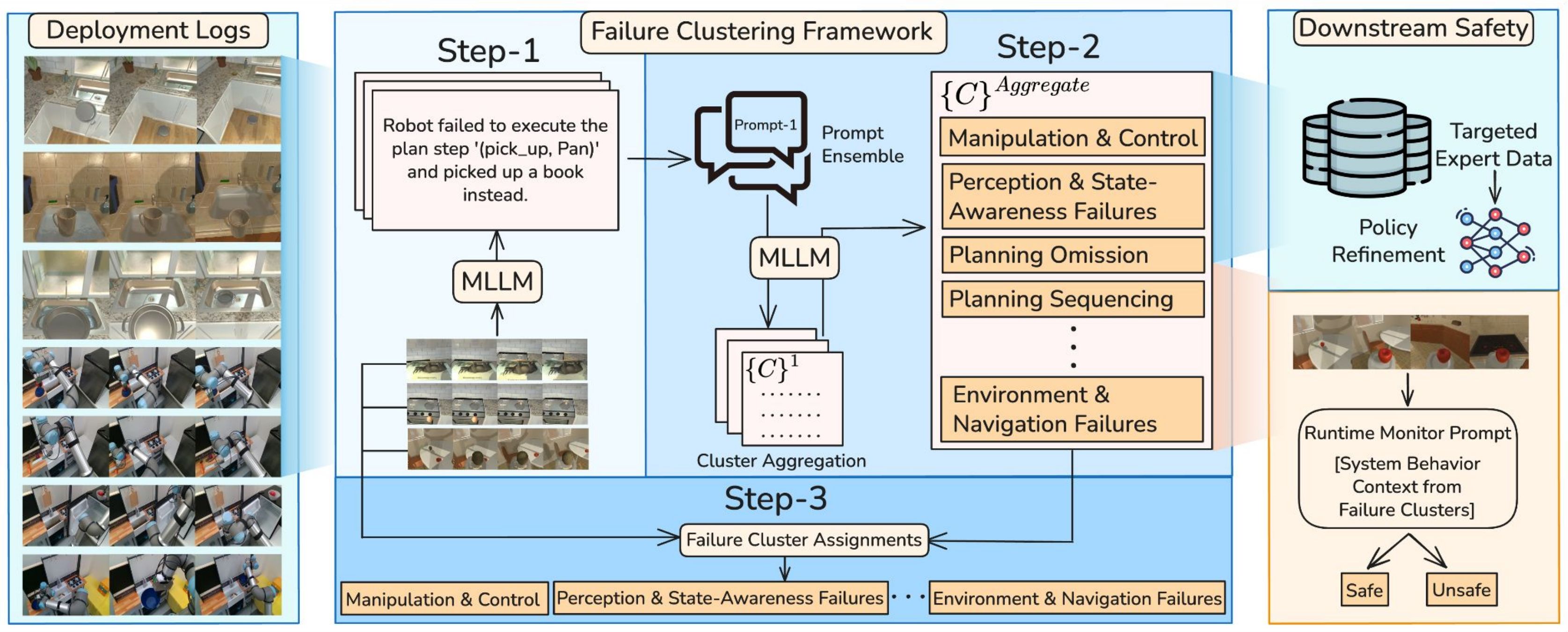
Find my research at https://aryamangupta.site/

Extracting Semantic Failure Modes from Deployment Data

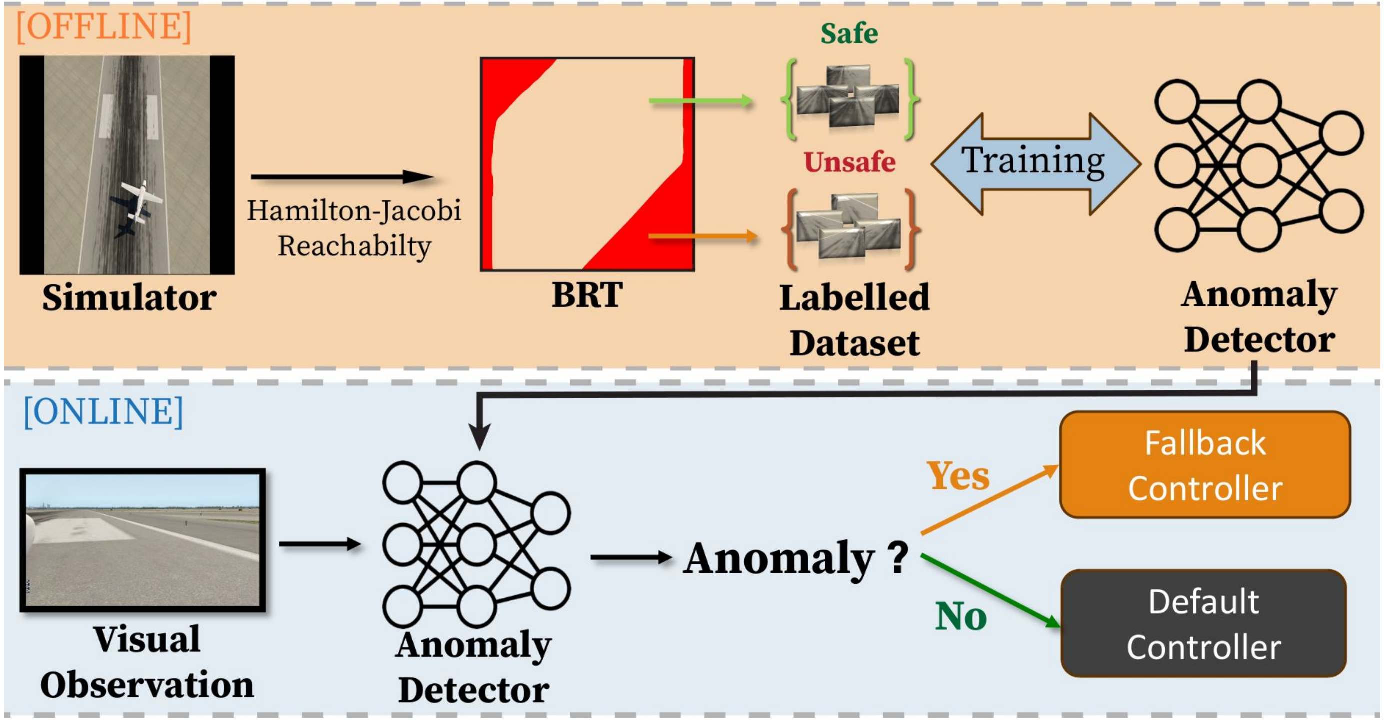
- Robots collect a lot of rich multimodal data while encountering failures during deployment. Interpreting this data to extract relevant information is unscalable, if done manually.
- We provide a framework leveraging LLMs to interpret this data and extract system's failure modes, and show its utility in offline policy improvement and runtime failure monitoring.



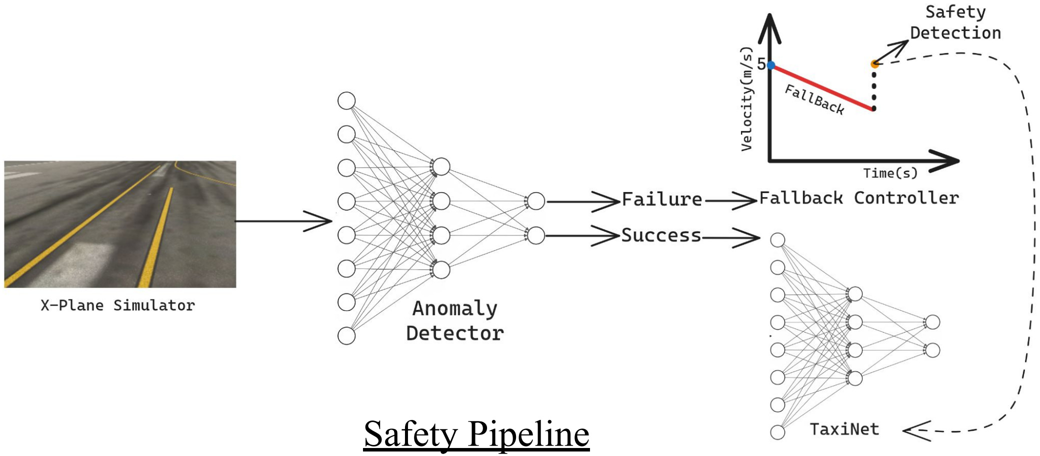
[Paper] [Video] [Website]

Safety Assurances of Visual Controllers

- Vision-based controllers are widely used in robotic applications. However, these controllers undergo closed-loop system safety violations when integrated in real-world safety-critical applications.
- We need a method to detect and mitigate these failures at runtime in novel environments.



Safety Assurances of Visual Controllers



Safety Pipeline

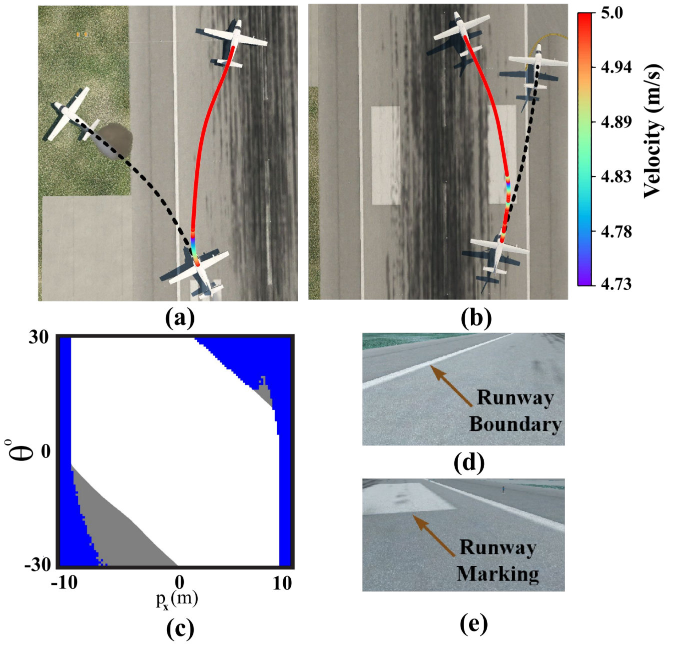


Fig.(a,b) Aircraft Trajectories under perception controller(black) and safety pipeline(red), Fig.(c) BRT comparison showing decrease in failure volume, Fig.(d,e) Failures due to runway boundary and markings

- **Published** and **Presented** in "**ICRA 2024**".
- Extensions:
  - Parameterized Neural Reachable Tubes instead of BRTs
  - Statistical Guarantees using Conformal Prediction
  - Additional Baselines and Fallback Mechanisms
- Under review at **IEEE T-RO**.

[Paper] [Presentation] [Video] [Website] [Code]

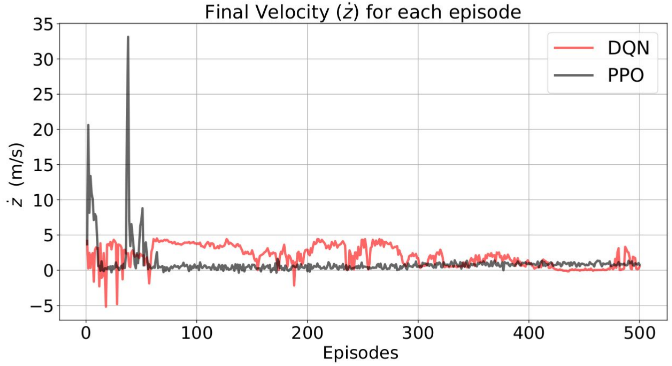
Docking Mechanism for VTOL-UAVs on Offshore Platforms

Deep-RL based docking mechanism for UAVs on offshore charging platforms having hydrodynamic disturbances.

- Formulated the reward function to land precisely and softly on docking station.
- PPO agent showcased better performance as compared to DQN agents.

Table 1: Performance Comparison of Trained Agents

Agent	Impact Velocity(m/s)	Landing Time(s)	Inference Time(ms)
PPO	0.327	**4.9**	**6.788**
DQN	0.820	5.4	9.854
Double DQN	**0.223**	7.7	7.220
Dueling DQN	2.419	6.3	11.296



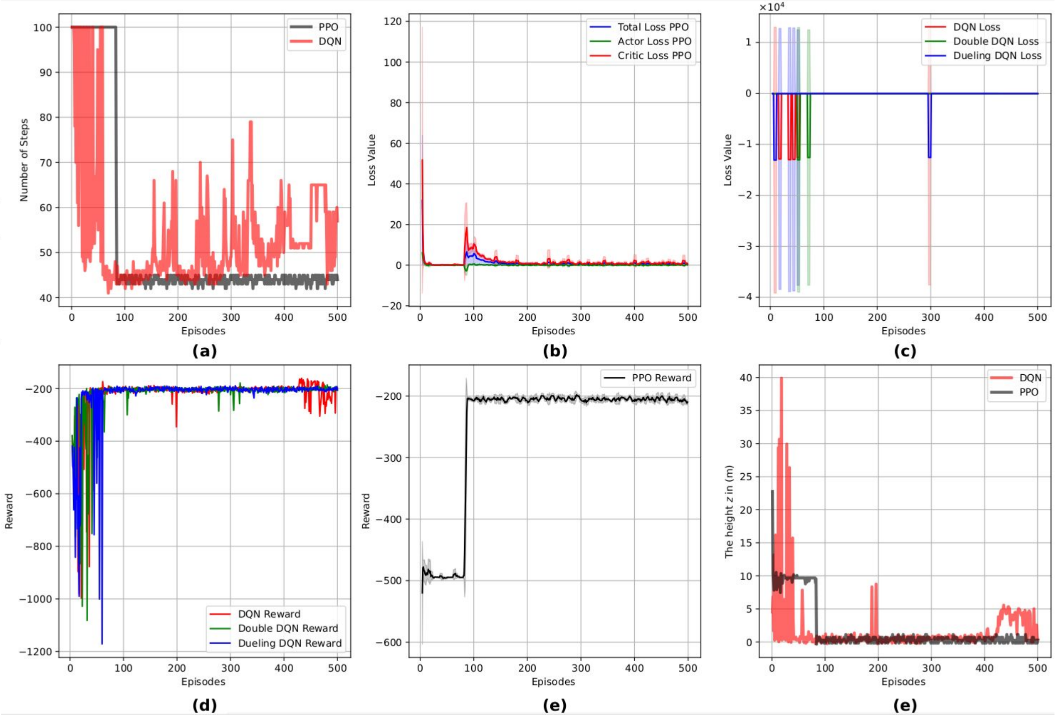


Fig.(a) Comparison between number of time-steps needed to land, Fig.(b) PPO agent loss, Fig.(c) DQN agents loss, Fig.(d) DQN agents reward, Fig.(e) PPO agent reward, Fig.(f) Final height achieved by DQN and PPO agents. Shaded parts in all figures represent the standard deviation of the moving average.

Paper **Accepted** in "**Applied Soft Computing Journal**"

[Paper] [Website] [Code]