METHODOLOGY PROPOSAL

**AI-Powered Space Mission Risk Prediction Framework**

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INSIGHTS –

**Applications and Challenges of Artificial Intelligence in Space Missions**

This paper (link attached on the last page) had really useful information on the use of AI-ML models and algorithms which are used on space-flight safety .

Some of the basic topics which this paper covered was how some problems in space flight safety paved way for AI to take over and be used as solutions .For example , the failure of the Challenger spacecraft and Soyuz spacecraft triggered a thought , that instead of humans cross-checking every sensor values , with the spacecraft using more than hundreds of sensors , it would be better for us to train AI to look and take autonomous decisions.

Also , how different AI models , like Fish Swarm Algorithm and Artificial Immune System Algorithm help in anomaly detection in space flights .

The major problem these days is air traffic ,especially in Low Earth Orbits(LEO), which result is potential collision risk between satellites and satellite-junk debris of previous satellites . To prevent satellite collisions in increasingly crowded low Earth orbits, I propose using a decentralized fish swarm algorithm . Fish-swarm algorithm can be thought of as the following situation -every fish tries to find an optimal solution , and if the solution is better than the present solution , and there is enough space for the whole swarm , the solution is changed to the better version . We can draw an equivalent to the fish swarm algorithm (satellite=fish )where each satellite autonomously senses nearby satellites and adjusts its orbit slightly to avoid potential collisions. This mimics natural swarm behavior and allows for adaptive, local decision-making using AI-ML , without centralized control ,where the satellite takes autonomous decisions . In my prototype, I simulate simplified orbits and use threat prediction based on position extrapolation. This offers a novel AI-based framework for future space traffic coordination. This idea might provide challenges , as I am still working on it . There might also be other variations of this idea present which might provide a better solution .

Another idea which I think can be deployed is to make simple if-else codes , which helps to check the sensor values , and deploy corrective measures if an anomaly arises . For example-the fuel tank temperatures must be from -170 degree Celsius to -160 degree Celsius . So if the sensor values escape this range , or it changes drastically in a short period of time , the code can raise an error and AI-ML models can try and find the anomaly. An example code is given in the file – Temperature\_checker.py

REFERENCES –

<https://ieeexplore.ieee.org/document/9634015>

A paper on AI-ML usage in space-flights