

Predicting Battery Consumption of Drones for Last-Mile Delivery Application

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Future Supply-Chain and Logistics:

- Drones for Last-Mile Delivery:

- ✓ Minimum Operation Footprint:
 - Vertical Flight
 - Small Size
 - Agile



- ✗ Inefficient Energy Consumption:

No Gliding/Lift force



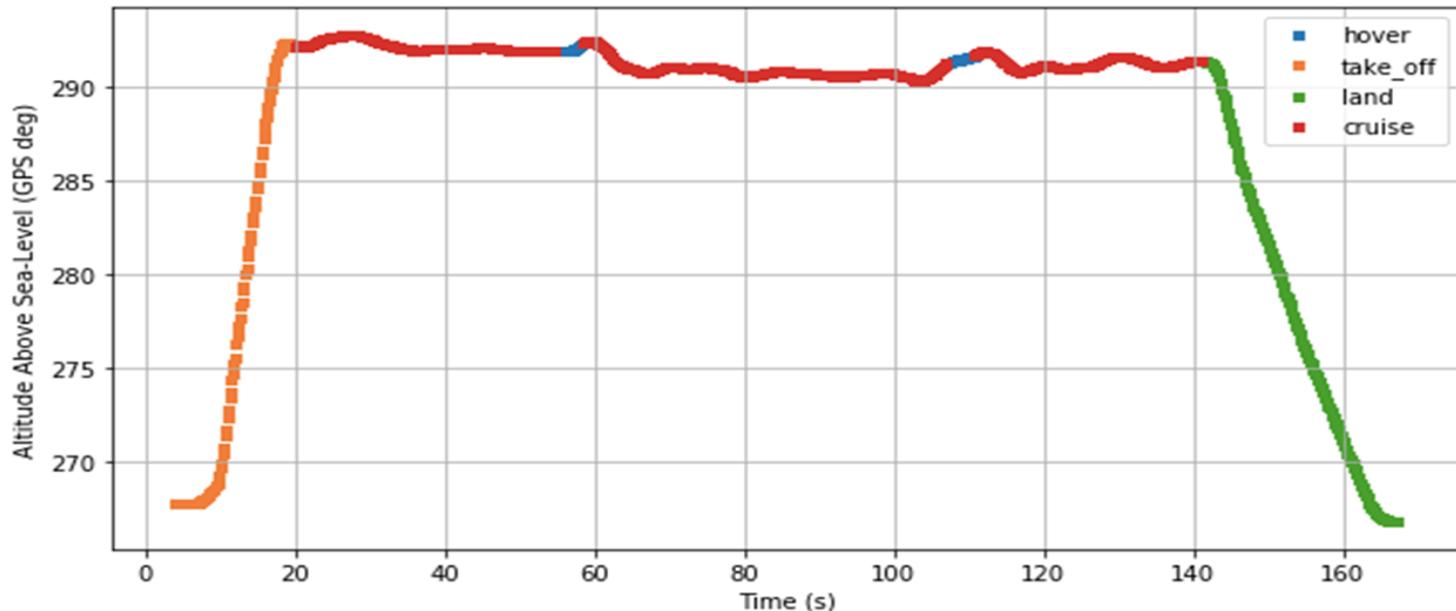
- To optimize battery consumption,
we need to be able to predict

- Battery-Life Reduction
- Unwanted Emergency landing
 - Public Safety
 - Damage to Drone/Cargo

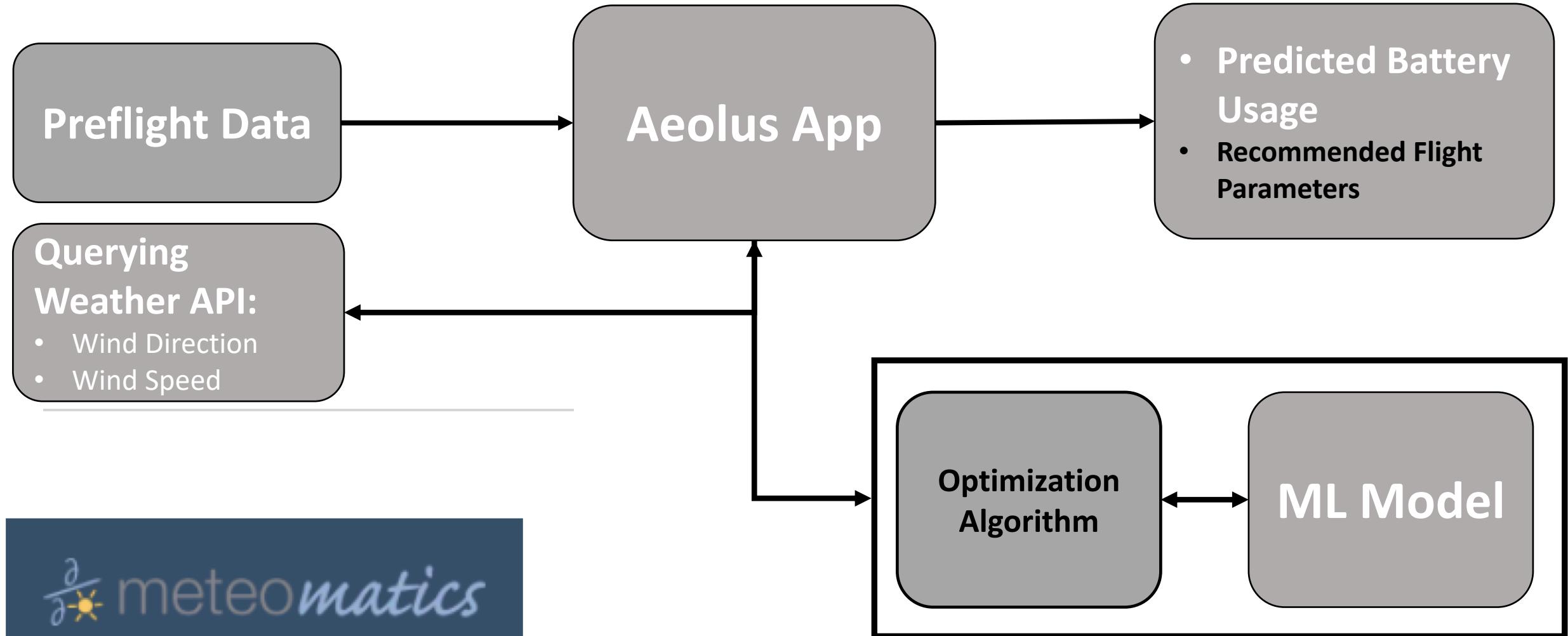
Machine Learning Modeling Results:

- Using a dataset of **182** drone flight tests
- Robust convergence to ~ **88%** precession with no over-fitting
- Ability to identify various **flight phases** and their individual roles in **battery consumption**

Model	Linear Regression (Baseline)	XGBoost Regression (Advanced Model)	GridSearch + XGBoost (Optimized Model)
Test RMSE	22.62	19.30	18.86
Train R2	88.3%	99.9%	87.7%
Test R2	82.4%	87.2%	87.7%



Aeolus: Predictor/Optimizer App



Aeolus Demo:



payload (g)	<input type="range" value="550"/>	550	Latitude:	<input type="text" value="71.89"/>
distance (m)	<input type="range" value="800"/>	800	Longitude:	<input type="text" value="-90.52"/> ▾
direction (d...)	<input type="range" value="170"/>	170	Calculate	
speed (m/s)	<input type="range" value="9"/>	9	Predicted Battery Usage = 32.19 Wh	
altitude (m)	<input type="range" value="90"/>	90	Current Wind Speed at Flight Altitude = 10.8 m/s	
			Current Wind Direction at Flight Altitude = -208.9 deg (CW relative to North)	

Adaptability:



- Main Idea: studying different parts of a process vs. time to optimize resources or goals
- Other applications:
 - Financial: Profitability in a business consisting of different parts
 - Manufacturing: Optimization of time in automation processes