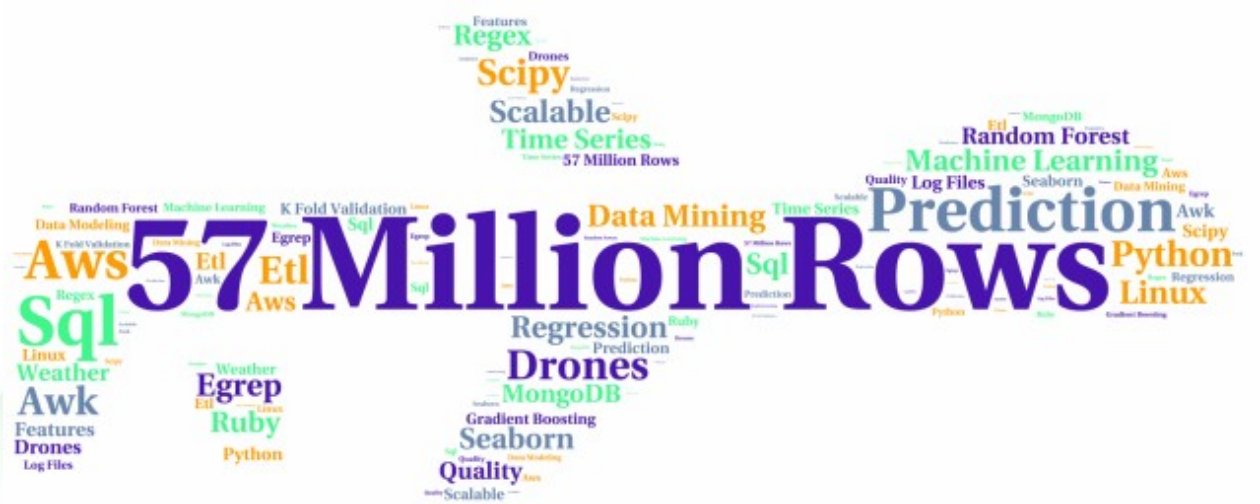
Drone Flight Quality Prediction



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MS Applied Statistics

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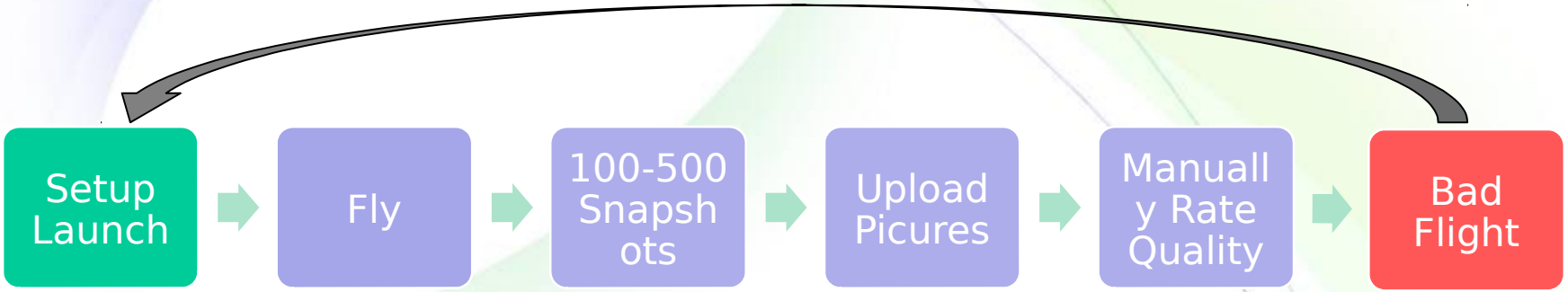
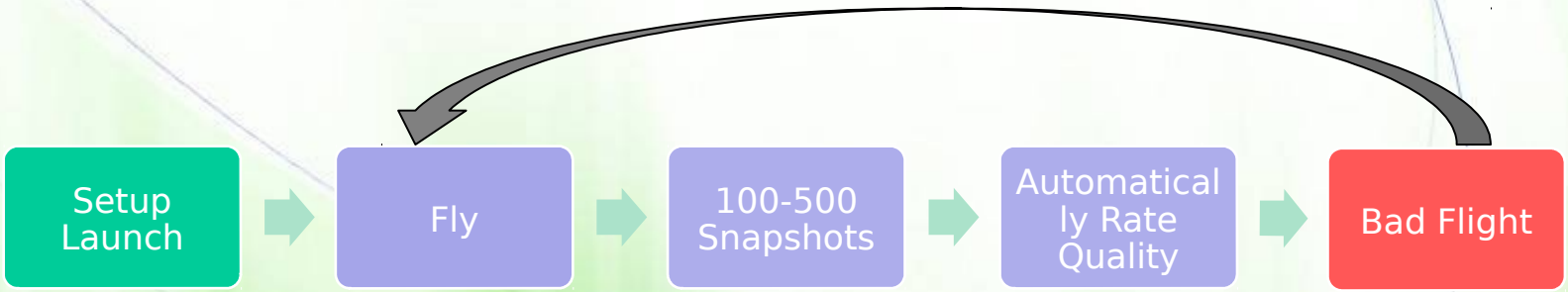
Agricultural Drone Flight

- **BEFORE** – Manual Picture Rating – 24 to 48 Hour Delay

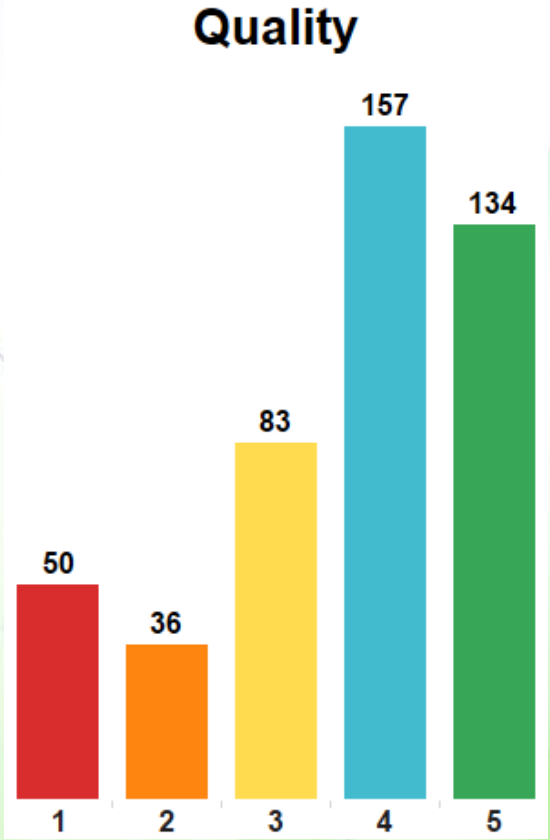


- **AFTER - MACHINE LEARNING** – On Site Relaunch



Maximize Opportunities to Fail Fast

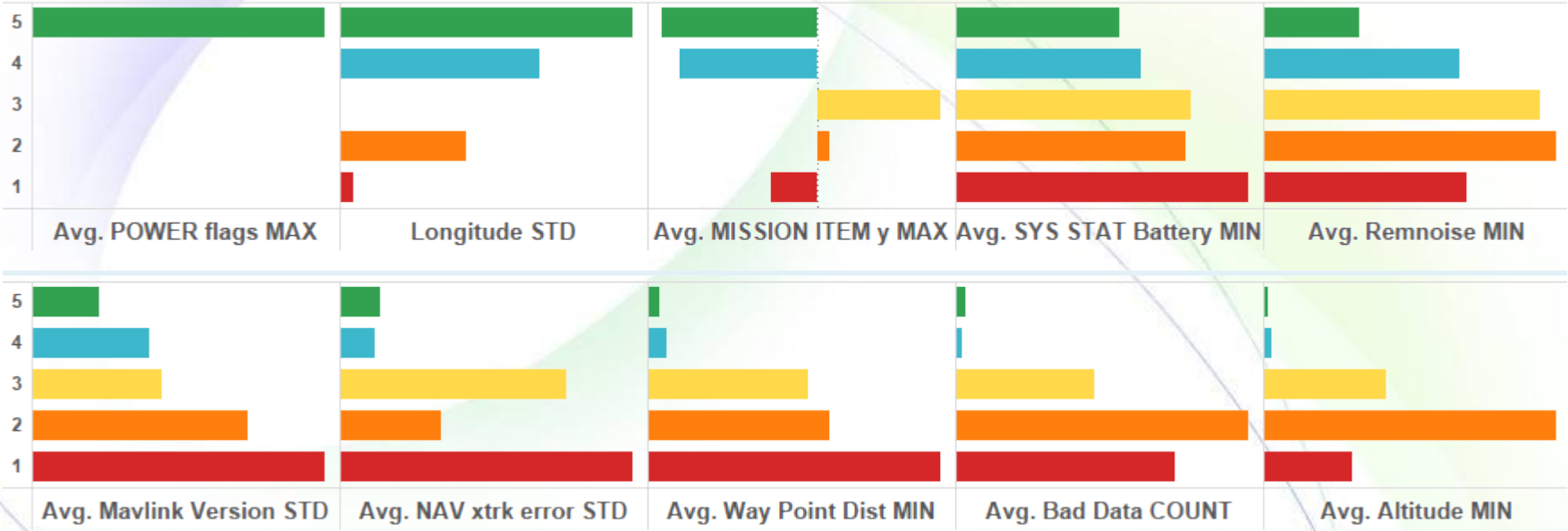
Picture Quality Rating



2015-09-09 22:09:21.87: BAD_DATA {unknown MAVLink message ID 94, data:['fe', '0', 'b4', 'f', 'ab', '5e', 'ff', 'e8']}
2015-09-09 22:09:22.17: POWER_STATUS {Vcc : 5214, Vservo : 5005, flags : 35}
2015-09-09 22:09:24.35: RADIO_STATUS {rssi : 218, remrssi : 217, txbuf : 96, noise : 51, remnoise : 65, rxerrors : 0, fixed : 0}
2015-09-09 22:09:25.69: MISSION_ITEM {target_system : 1, target_component : 1, seq : 16, frame : 3, command : 16, current : 0, autocontinue : 1, param1 : 0.0, param2 : 0.0, param3 : 0.0, param4 : 0.0, x : 40.316570282, y : -83.2359924316, z : 80.0}
2015-09-09 22:09:28.17: NAV_CONTROLLER_OUTPUT {nav_roll : 0.0, nav_pitch : 0.0, nav_bearing : 0, target_bearing : 0, wp_dist : 50, alt_error : 0.569999992847,
aspd_error : -0.0362006574869, xtrack_error : 0.0}

Flexible Log Parser for Unknown Variable Names

Log Feature Engineering



- Ability to use a feature to model quality
- Average Feature Values Over all 500 flights
- Time Series Aggregation: 50,000 row log file reduced to one row

Find the Signal in the Noise

Machine Learning Process

Data Sources

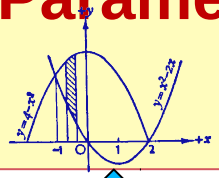
Dron e Fligh t Logs

Locati on Weath er

Pre-Processing – regex

Bash Pull and organize Into sparse data frame

Supervised Model Evaluations and Parameter Tuning



Feature Engineering

Local Forecast Application

Robust Results for Easy Interpretation

Finding the Best Pre

Winner!

PREDICTIVE MODEL	CLASSIFIER Mean Absolute Error	REGRESSION Mean Absolute Error
Gradient Boost	0.39	0.43
Random Forest	0.39	0.46
Ada Boost	1.03	0.91
Lasso	N/A	1.00
Support Vector Polynomial	1.10	1.04
Ridge	1.44	1.55

- Cross Validation Shuffle Split Mean
- Grid Search Parameter Optimization
- AWS Processing

Ordered Integer Values Work with Classes and Regression

Next Steps

- Validate Prediction in the Field
- Measure any reduction in manual picture re-touching
- Automate Drone Failure Detection
- Time Series Launch and Landing segments versus cruising metrics

Diagnostic Possibilities

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Thank-you Galvanize, Agribotix and fellow classmates!

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