Drone Data Analysis

Data Processing and Visualization Samples

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A DATA SCIENCE WORKFLOW MODEL

1. Understand the problem
2. Acquire the data
3. Understand data
   Fix, Parse, and analyze the data
4. Refine the data
5. Create and test model
6. Present the results, disseminate information
   - Share findings, visualizations and models

In any autonomous flight mission, the number of UAVs needed to accomplish a mission is very important in order to keep SLA of the Service.

As an example, think about Fire Rescue: several considerations need to be taken to define the right number of units that can perform de Job.

Environmental conditions such as Weather, Season, Territory coverage extension, Altitude, Closeness to the water can influence the Drone Performance.

Drone Data: Battery Capacity, Sensors Information, etc.

First question to answer will be: How many drones do I need in a fleet to accomplish a mission?

A mission can be a fire rescue, a monitoring service, an agriculture scenario, etc.

UAV

Real Time Video

Camera

Battery

Gimbal

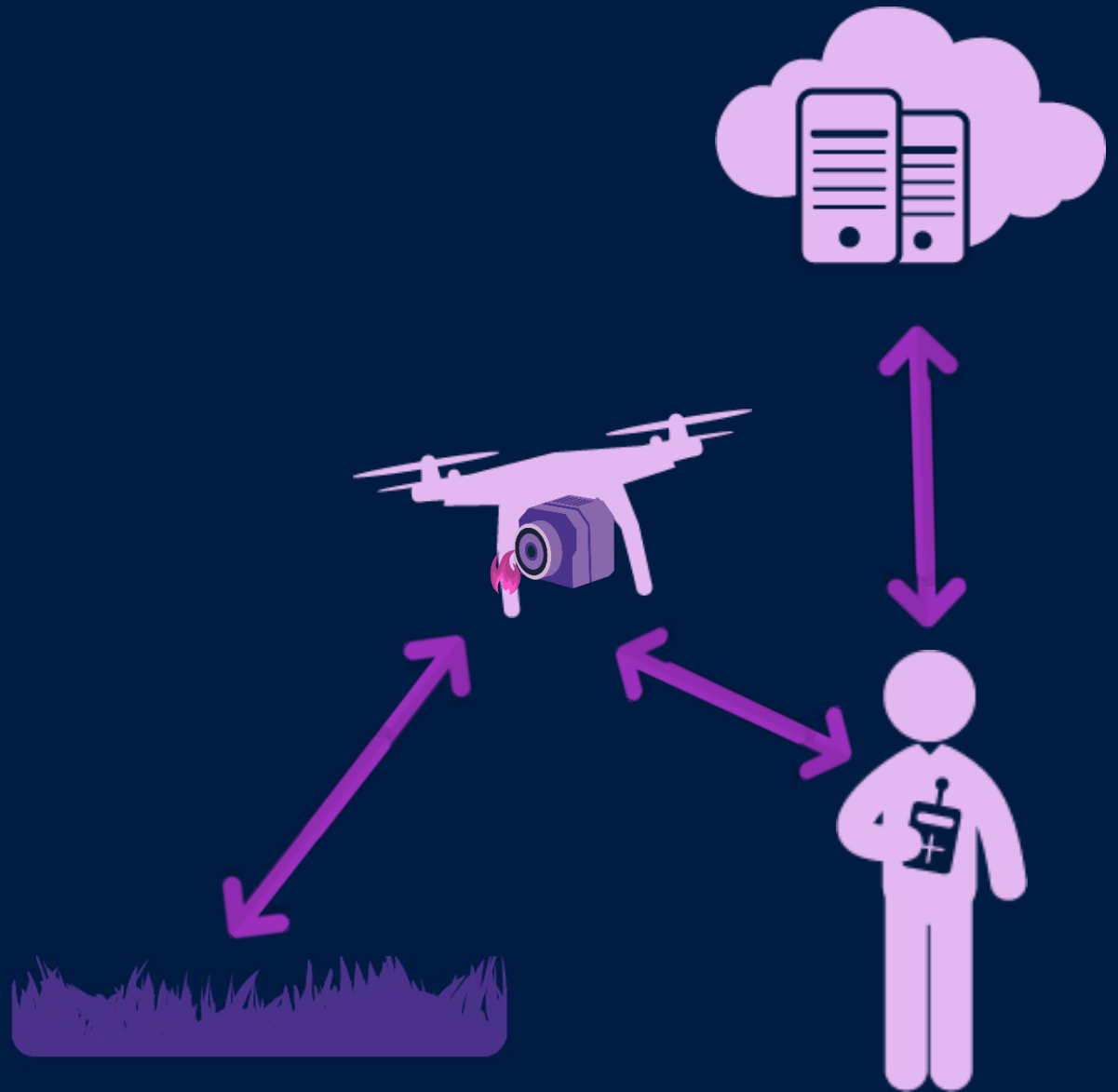
Flight Controller

RC

Ground Base

UAS Components

- Drone
- Sensors: Accelerometer, Giroscope, magno meter, Ultrasound
- Ground Base
- Thermal / Infrared camera
- Cloud Services
- Reports



Acquiring the data

My Data sources will be:
For weather I will use the underground Public Datasource
https://www.wunderground.com/weather/api/d/docs?MR=1

The Flight Data that is here and also I will need to add some other measurements such as Battery and Sensors operation.

Understanding the Data

OMAP Timestamp	SVs	Lat (1e-7 deg)	Lon (1e-7 deg)	Alt (m)	North Velocity (m/s)	East Velocity (m/s)	Down Velocity (m/s)	Aircraft Roll (1e-4 rad)	Aircraft Pitch (1e-4 ra
9.46685E+14	8	442760089	-940902746	295.055	0.00802701	0.0023105	0.0466009	-1062	-2
9.46685E+14	8	442760089	-940902746	295.054	0.00523426	0.0016403	0.0470197	-1053	-2
9.46685E+14	8	442760089	-940902746	295.066	0.00309631	0.00303711	0.0425703	-1059	-2
9.46685E+14	8	442760089	-940902746	295.065	0.00913553	0.00389044	0.0405679	-1062	-2
9.46685E+14	8	442760089	-940902746	295.064	0.00536658	0.00307408	0.0408834	-1053	-2
9.46685E+14	8	442760089	-940902746	295.062	0.00485383	0.0028196	0.0401257	-1061	-2
9.46685E+14	8	442760089	-940902746	295.061	0.0109315	0.00369404	0.0381244	-1062	-2
9.46685E+14	8	442760089	-940902746	295.06	0.00716197	0.00287825	0.0384404	-1051	-2
9.46685E+14	8	442760089	-940902746	295.059	0.00603726	0.00251291	0.0381088	-1053	-2
9.46685E+14	8	442760089	-940902746	295.057	0.0108439	0.0031405	0.0369545	-1060	-2
9.46685E+14	8	442760089	-940902746	295.068	0.00780367	0.00210639	0.0391873	-1053	-2
9.46685E+14	8	442760089	-940902746	295.066	0.00676279	0.00176528	0.0383808	-1050	-2
9.46685E+14	8	442760089	-940902746	295.065	0.0100524	0.00214755	0.0370739	-1058	-2
9.46685E+14	8	442760089	-940902746	295.064	0.0116457	0.00224285	0.0360432	-1057	-2
9.46685E+14	8	442760089	-940902746	295.063	0.00781769	0.00141364	0.0358848	-1054	-2
9.46685E+14	8	442760089	-940902746	295.062	0.0108168	0.00175285	0.0340525	-1061	-2
9.46685E+14	8	442760089	-940902746	295.06	0.0115113	0.00170094	0.0329229	-1056	-2
9.46685E+14	8	442760089	-940902746	295.059	0.00954232	0.0011763	0.0329673	-1055	-2
9.46685E+14	8	442760089	-940902746	295.07	0.00965334	0.000428788	0.0304509	-1060	-2
9.46685E+14	8	442760089	-940902746	295.069	0.0093093	0.000195338	0.0296938	-1054	-2
9.46685E+14	8	442760089	-940902746	295.068	0.00930409	0.0000142	0.0289868	-1059	-2
9.46685E+14	8	442760089	-940902746	295.067	0.0119526	0.000286673	0.027581	-1061	-2
9.46685E+14	8	442760089	-940902746	295.066	0.00963388	-0.000297274	0.0275738	-1053	-2
9.46685E+14	8	442760089	-940902746	295.065	0.0115662	-0.000155082	0.0261166	-1059	-2
9.46685E+14	8	442760089	-940902746	295.064	0.0146845	0.000180619	0.0247616	-1062	-2

Understanding the Data

http://api.wunderground.com/api/*1150673d7b3a40f6*/conditions/q/CA/San_Francisco.json


```
{
  "response": {
  "version":"0.1",
  "termsofService":"http://www.wunderground.com/weather/api/d/terms.html",
  "features": {
  "conditions": 1
  }
      }
,     "current_observation": {
              "image": {
              "url":"http://icons.wxug.com/graphics/wu2/logo_130x80.png",
              "title":"Weather Underground",
              "link":"http://www.wunderground.com"
              },
              "display_location": {
              "full":"Seattle, WA",
              "city":"Seattle",
              "state":"WA",
              "state_name":"Washington",
              "country":"US",
              "country_iso3166":"US",
              "zip":"98101",
              "magic":"1",
              "wmo":"99999",
              "latitude":"47.61167908",
              "longitude":"-122.33325958",
              "elevation":"63.00000000"
              },
              "observation_location": {
              "full":"Belltown, Seattle, Washington",
              "city":"Belltown, Seattle",
              "state":"Washington",
              "country":"US",
              "country_iso3166":"US",
              "latitude":"47.612675",
              "longitude":"-122.347694",
              "elevation":"135 ft"
              }
```


https://github.com/guadacasuso/DroneDataAnalytics/blob/master/Data/SeattleWeather.json

Feature Selection

Season

Location

Equipment

Battery type

-> Time flying

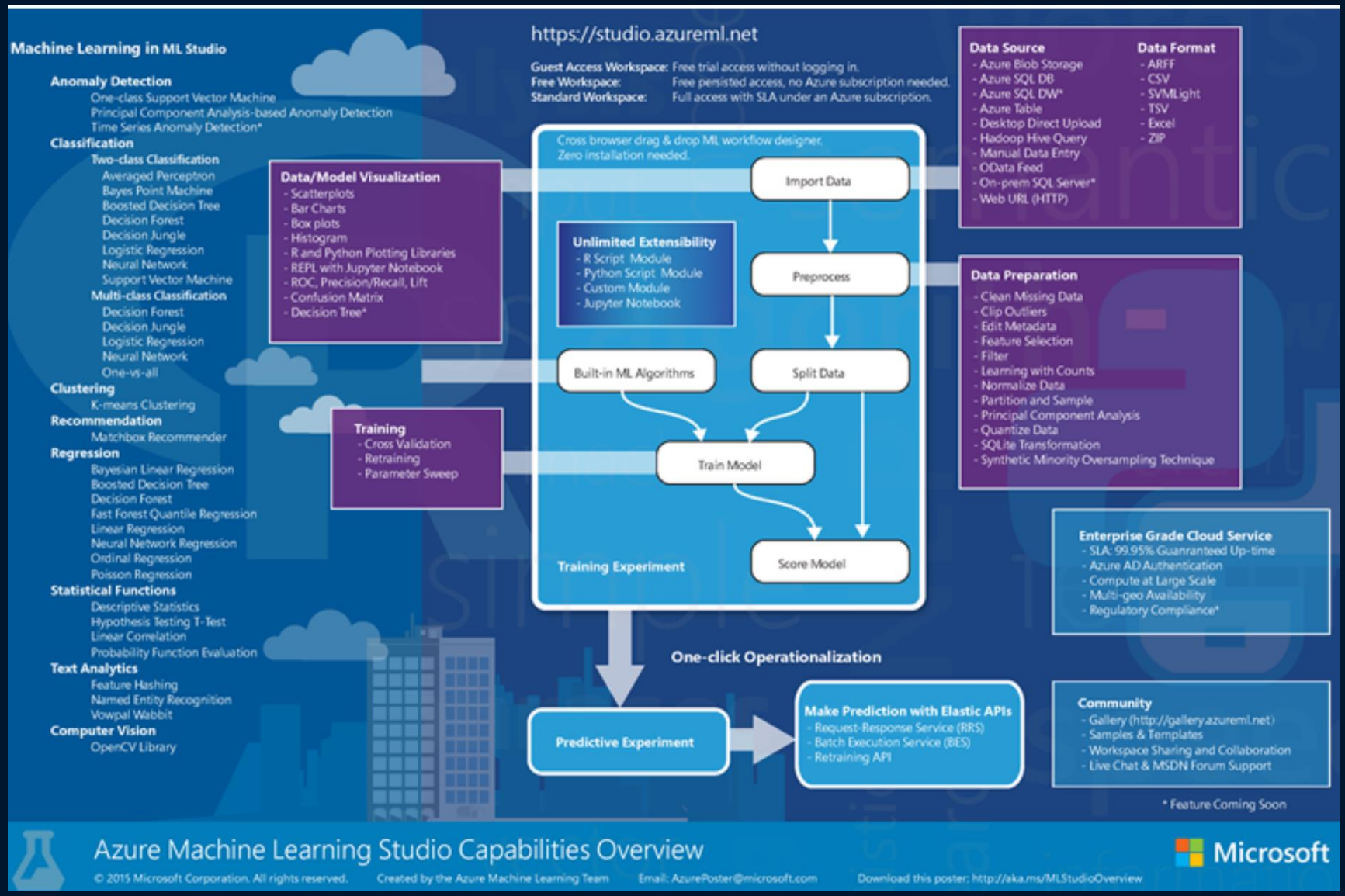
Hectares to cover and Hs of operation vrs #drones

What's Next?

Refining the Data

Create and Test the Model

Present the Results


Machine Learning in ML Studio
Anomaly Detection
One-class Support Vector Machine
Principal Component Analysis-based Anomaly Detection
Time Series Anomaly Detection*
Classification
Two-class Classification
Averaged Perceptron
Bayes Point Machine
Boosted Decision Tree
Decision Forest
Decision Jungle
Logistic Regression
Neural Network
Support Vector Machine
Multi-class Classification
Decision Forest
Decision Jungle
Logistic Regression
Neural Network
One-vs-all
Clustering
K-means Clustering
Recommendation
Matchbox Recommender
Regression
Bayesian Linear Regression
Boosted Decision Tree
Decision Forest
Fast Forest Quantile Regression
Linear Regression
Neural Network Regression
Ordinal Regression
Poisson Regression
Statistical Functions
Descriptive Statistics
Hypothesis Testing T-Test
Linear Correlation
Probability Function Evaluation
Text Analytics
Feature Hashing
Named Entity Recognition
Vowpal Wabbit
Computer Vision
OpenCV Library
https://studio.azureml.net
Guest Access Workspace: Free trial access without logging in.
Free Workspace: Free persisted access, no Azure subscription needed.
Standard Workspace: Full access with SLA under an Azure subscription.
Data/Model Visualization
- Scatterplots
- Bar Charts
- Box plots
- Histogram
- R and Python Plotting Libraries
- REPL with Jupyter Notebook
- ROC, Precision/Recall, Lift
- Confusion Matrix
- Decision Tree*
Training
- Cross Validation
- Retraining
- Parameter Sweep
Cross browser drag & drop ML workflow designer.
Zero installation needed.
Import Data
Unlimited Extensibility
- R Script Module
- Python Script Module
- Custom Module
- Jupyter Notebook
Preprocess
Built-in ML Algorithms
Split Data
Train Model
Score Model
Training Experiment
Data Source
- Azure Blob Storage
- Azure SQL DB
- Azure SQL DW*
- Azure Table
- Desktop Direct Upload
- Hadoop Hive Query
- Manual Data Entry
- OData Feed
- On-prem SQL Server*
- Web URL (HTTP)
Data Format
- ARFF
- CSV
- SVMLight
- TSV
- Excel
- ZIP
Data Preparation
- Clean Missing Data
- Clip Outliers
- Edit Metadata
- Feature Selection
- Filter
- Learning with Counts
- Normalize Data
- Partition and Sample
- Principal Component Analysis
- Quantize Data
- SQLite Transformation
- Synthetic Minority Oversampling Technique
Enterprise Grade Cloud Service
- SLA: 99.95% Guanranteed Up-time
- Azure AD Authentication
- Compute at Large Scale
- Multi-geo Availability
- Regulatory Compliance*
One-click Operationalization
Predictive Experiment
Make Prediction with Elastic APIs
- Request-Response Service (RRS)
- Batch Execution Service (BES)
- Retraining API
Community
- Gallery (http://gallery.azureml.net)
- Samples & Templates
- Workspace Sharing and Collaboration
- Live Chat & MSDN Forum Support
* Feature Coming Soon
Azure Machine Learning Studio Capabilities Overview
© 2015 Microsoft Corporation. All rights reserved.
Created by the Azure Machine Learning Team
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