Product Backlog for WPEAR

Team 5

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Problem Statement

Forecast accuracy is an important topic in both operational forecasting and atmospheric research. In order to facilitate accuracy in forecasts we must measure the difference in what was forecasted and what happened. To meet this need we will be designing and implementing a pipeline which will take publicly available forecasts and data from weather instruments and create derivative products with statistical information about the accuracy of the forecasts. The products will consist of visualizations on a website as well as grib files that can be used to do further analysis of the data.

Definitions

- NEXRAD Radar - A US based network of radar stations that primarily detect reflectivity. (Map of NEXRAD Radar Stations: https://www.roc.noaa.gov/wsr88d/maps.aspx)

- Multi-Radar/Multi-Sensor System (MRMS) - MRMS is a system with automated algorithms that quickly and intelligently integrate data streams from multiple radars, surface and upper air observations, lightning detection systems, and satellite and forecast models. (Further information: http://www.nssl.noaa.gov/projects/mrms/)

- NWS - US National Weather Service (Further Information: http://www.weather.gov/)

- Grid Spacing - In weather models the grid spacing is the size of each “pixel” in a forecast or observation. A common grid spacing is a 4 sq. km or 2 sq. km square area. (Further information: http://weather.mailasail.com/Franks-Weather/Grid-Length-Resolution)

Background Information:

Most forecast evaluation systems are written exclusively for a specific weather forecast such as the Indianapolis NWS forecast. We are proposing a general solution with appropriate converters to be able to evaluate multiple forecasts based on multiple types of observations (such as data from the NEXRAD Radar System or the MRMS). This will allow us to evaluate many different variables such as Temperature or Reflectivity across multiple forecasts and generate visualizations that can help researchers determine what the strengths and deficiencies of specific forecasts are. This type of system will also allow for new forecasts and observation data to calculated and visualized trivially.

Requirements

- **Functional Requirements**

Backlog ID	Functional Requirement
1	As a user, I would like to obtain latest observation data from the given sources.
2	As a user, I would like to have the data interpolated before evaluation for the visualizations.
3	As a user, I would like to be be able to generate visualizations based on data specifically for a certain region.
4	As a user, I would like to choose between different variables (for instance reflectivity or temperature) for a particular visualization.
5	As a developer, I would like for observation data to be in a common format (grid spacing and variables)
6	As a developer, I would like for forecast data to be in a common format (grid spacing and variables).
7	As a developer, I would like to be able to calculate the difference of a particular variable over time or over a specific region.
8	As a developer, I would like to be able to calculate the mean temperature for a given region over multiple forecasts.
9	As a user, I would like to view a static heatmap of the forecasted weather.
10	As a user, I would like to view a static heatmap of the observed weather.
11	As a user, I would like to view a static visualization of the comparison done using difference.
12	As a user, I would like to use date/hour information to navigate the website and pick the visualization I want to see.
13	As a user, I would like to view a moving heatmap of the forecasted weather.
14	As a user, I would like to view a moving heatmap of the difference between observed weather vs forecasted weather.
15	As a user, I would like to view the results via website.
16	As a user, I would like to view a X-Y scatter graph showing the standard deviation between a selected observation and its forecasts.
`17	As a user, I would like to view a moving visualization of the comparison done using root mean square difference. (if time permits)
18	As a user, I would like to visualizations of observation to be available in real-time.

19	As a user, I would like to view a graph showing the accuracy of a specific variable based on how far out have they been forecasted (if time permits).
20	As a developer, I would like to perform evaluation calculations on the observation and forecast and compare the models. (if time permits)
21	As a user, I would like to be able to download the data files used to generate the visualizations
22	As a user, I would like to see the difference between the results from top accurate weather forecast and the worst accurate weather forecast. (if time permits)
23	As a user, I would like to take geographical position and see the changing forecast for the past 24 hours.
24	As a developer, I would like to standardize and cleanup the code from the last two sprints.
25	As a user, I would like to be able to store the models for each observation and forecast in separate files.
26	As a developer I would like a class that orchestrates the downloading, conversion, comparison and visualization of the data
27	As a developer, I would like to be able to calculate the mean of a particular variable over time or over a specific region. Implemented as MultiSetAverage

- **Non-Functional Requirements**

1. **Web Enabled:** Visualizations must be available over the web. Webpages must be autogenerated based on the visualizations that are to be displayed using type of visualization, date/time, location and variable as parameters.

2. **Intermediate Data Archival:** Interpolated intermediate data must be available historically for reanalysis of visualizations. Archived data must be clearly marked with location, time/date and variable parameters. Archived data must be available via the web and linked to the visualizations that are created from it.

3. **Operational Weather:** Every hour this tool should retrieve the observations and forecasts, convert them to a common grid spacing and format and create visualizations based on an evaluation of the observation and forecast for specific points in time.

4. **Web access must be fast:** Webpages should be static HTML/CSS and not include any server side programing.

5. **Modular:** Code must be modularized in a way that adding new types of observations and forecasts is trivial.