Detection of Hydrologic Events

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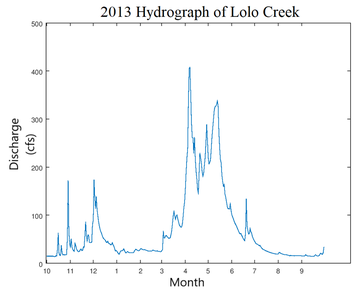
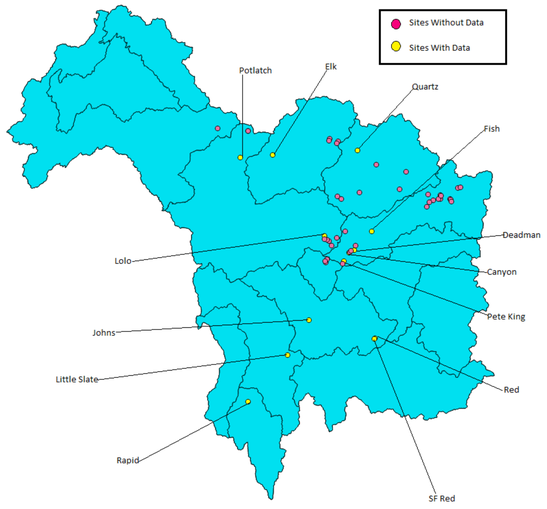
Overview

The Nez-Perce Clearwater National Forest Service is an organization that is tasked with the management of 4 million acres of land in the Nez-Perce Clearwater area. We are using daily discharge data, a volume of water per unit of time, from 13 different sites to create hydrographs. By applying data analytic techniques to precipitation data from National Oceanic and Atmospheric Administration and snow pack data from snow pack telemetry (SNOTEL) we can identify hydrologic events. Possible events include forest fires, floods, and landslides.

Background



Hydrologic events are defined as anything that significantly changes the discharge of a river from its normal discharge. Examples of these events include floods, forest fires, and snow pack melt.We have been provided with discharge data from 13 different sites throughout the NPCNF. We have also been using precipitation data from NOAA, fire data from MTBS, and snow pack data from SNOTEL.

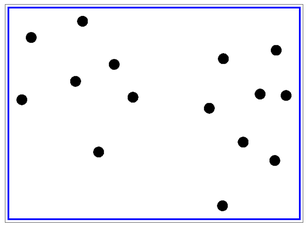


Methods

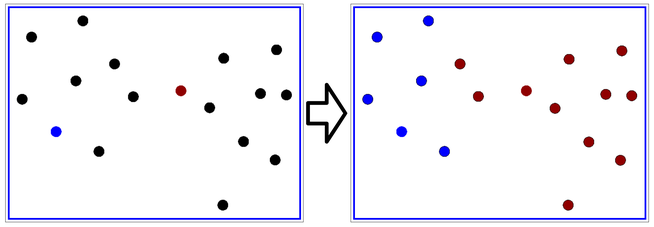
Feature Vectors

Feature vectors are vectors that contain many different features or measurable characteristics related to an event. This tool can be useful in comparisons between when events did and did not happen.

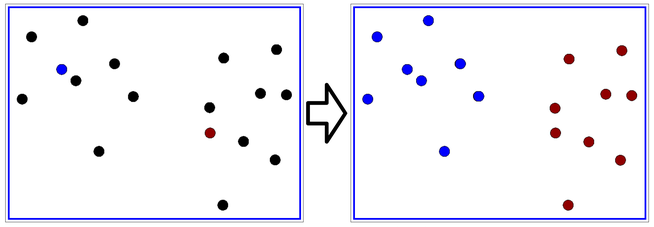
Clustering (K means)



A standard set of data

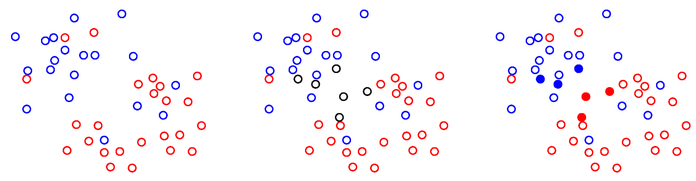


Two clusters are randomly selected and centers are calculated

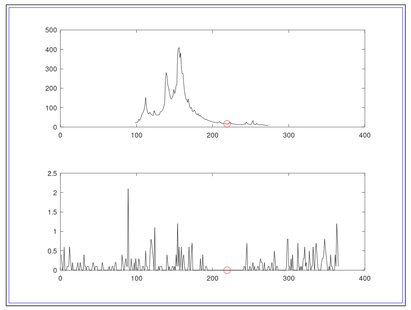


New centers are calculated and membership is recalculated

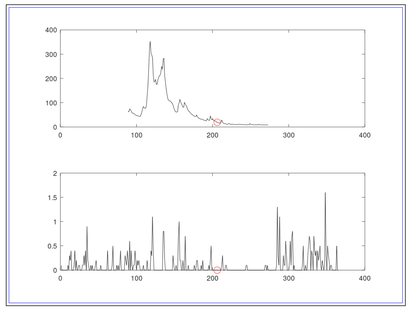
Support Vector Machine(SVM)



SVM is a technique in which known data is classified and separated via a plane. Unknown data is then input into the space and placed into the corresponding classification.



Discharge and Precipitation data for a representative non-fire.



Discharge and Precipitation data for a fire.

Results

Our best features were the sum of precipitation 5 days before and after a fire. The resulting feature vectors were:

Fires										Non-Fires									
0	0	0	0	0	0	0	0	0		0	0	0	0.7	0	0.1	0.1	0.6	0	
0	0	0.1	0	0.5	0	0	0.1	0		0.4	0.2	0	0.2	0	1.1	0.9	0.5	0.6	

These feature vectors led to the clusters:

$$\begin{array}{ll} Fires: & 2\ 2\ 2\ 2\ 2\ 2\ 2\ 2\ 2 \\ NonFires: & 2\ 2\ 2\ 1\ 2\ 1\ 1\ 1\ 2 \end{array}$$

When analyzed with SVM we had an average 65 percent correct classification of fires and non fires.

Future Work

Finding the features that separate fires and non-fires.

Once we find features that give good separation of fires and non-fires we will apply this method to other rivers in order to assure that the features are not specific to Red River.

When we have a working method for classifying fires we should be able to find features that classify other events.

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