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Project Proposal

The Working Group on California Earthquake Probabilities (WGCEP) is lately considering in its models "complex multi-segment rupture scenarios where earthquakes are no longer confined to separate, individual faults but can rupture multiple faults simultaneously on occasion. This reflects what seismologists have been observing from earthquakes around the world concerning the complexity of dependent fault interactions and stress triggering at depth for faults where, at the surface, these factors appear to be independent"(1). That is, it seems like assuming a given earthquake comes from rupture in a nearby fault may be too simplistic in many occasions. In the contest of dealing with induced seismicity studies in complex geological scenario, the idea of being able to better understand how earthquakes can be generated from multiple faults from observed data is very appealing (so we can better condition our computational models).

The general theme of this project is working with historical earthquake data in California. The first piece of data under consideration will be all earthquakes in that region with magnitude more than 3.5 over the last 20 or 25 years, which means thousands of earthquakes. These data are available to download from the IRIS repository http://www.iris.edu/hq/. The second piece of data that I'll be looking at will be an active fault map for the California region, which is available at http://maps.conservation.ca.gov/cgs/fam/. The basic idea of this particular project would be to find some patterns or trends between the fault lines and the reported earthquakes (characterized by their time, magnitude and location). Either temporal and spatial relationships (preferably both) should be the aim for this work. Within this general idea many things could be tried and tested. From the perspective of visualization, I can create some appealing visualizations such as showing earthquake epicenters and illuminating closest faults in a dynamic video or I can even generate an earthquake-energy density map. From the algorithmic point of view, I can try clustering earthquakes using soft clustering techniques such as "Fuzzy Clustering", so that we allow individual earthquakes belong to several clusters simultaneously (with different strengths). Each cluster can be representative of a major fault, or perhaps a major orientation (I'm not sure). The goal of this project is to see if we can identify some of these complex multi-segment rupture trends. In this project, MATLAB is a suffice tool to study the California Problem.

References:

(1) Retrieved from https://www.air-worldwide.com/Blog/A-Better-Understanding-of-California-s-Earthquake-Risk/