Title: Development of Statistical and Data Drive Models to Predict Solar Flares for Space Weather Predictions

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Summary:

Solar flares impact DoD and civilian assets in both space and ground. The current state of predictability of solar flares is based on once-a-day measurement and resultant change of solar activity parameters such as sunspot magnetic classification (NOAA Space Weather Prediction Center, and USAF/AFWA). With the advent of the USAF's prototype Improved Solar Observing Optical Network (ISOON) telescope, we have the capability to monitor rapid changes in characteristics of the solar chromosphere (1-minute cadence), photosphere (5-minute cadence), and corona (10-minute cadence). In addition, the National Solar Observatory's GONG telescope has the capability to measure full-disk solar photospheric magnetic fields at 1- and 10-minute cadence. These data sources (and other complementary space data) of past and current events will help us research, track and establish the relationship between the high-cadence variation of measured parameters at the various layers and solar flares. We utilize state-of-the-art techniques in image and signal analysis, developing a predictive model in a framework of feature extraction, selection, and classification with specific emphasis on the use of temporal aspects of the data. The goal is to demonstrate prediction of near-term probability of flare occurrence using real-time operational data sources improving upon existing flare prediction methods. This research will also seek to gain insights into physical mechanisms of the flaring process, aiding in the eventual development of physics based solar flare forecast models.