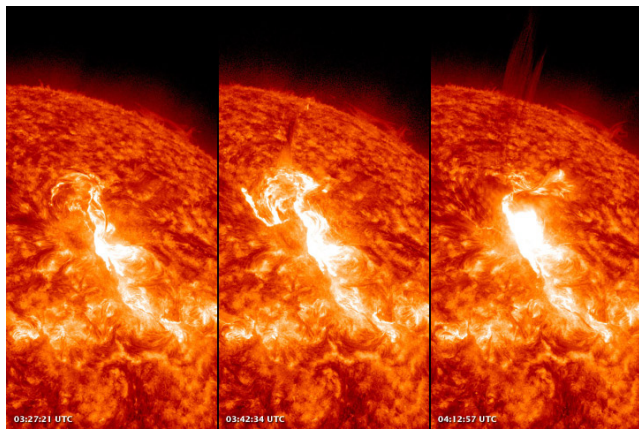# Interpreting LSTM Prediction on Solar Flare Eruption with Time-series Clustering

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Prediction Task & Data

Solar flare is a sudden flash of increased brightness on the Sun. Strong flares typically generate streams of highly energetic particles in the solar wind that may impact Earth's magnetosphere.

Prediction Task & Data

▶ Binary classification Task: Give forecast on the probability of seeing either a strong solar flare (M or X class flare) or a weak solar flare (B class flare) in the next hour.

▶ Data: 97 M/X flares and 305 B flares.
20 1-hour time series of physics parameters (12 min cadence) about the local magnetic field where flare originates, collected 1 hour before the flare time.
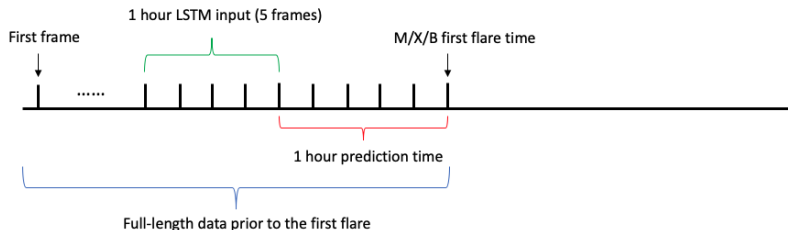
Deep Learning Architecture

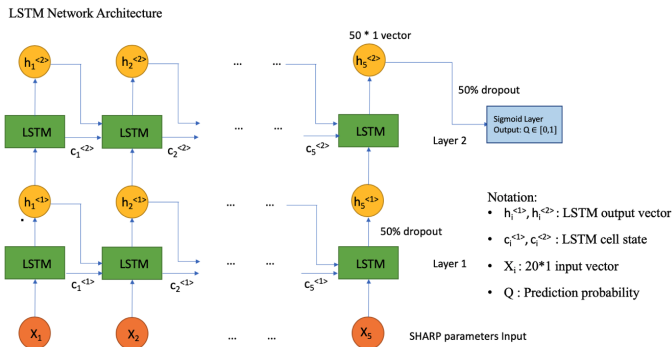We use Long-Short-Term-Memory (LSTM) model to learn the multi-dimensional time series input.

Figure: 2 LSTM layers neural network

Core Results

For many strong flares, we see a **sudden transition** of LSTM predicted probabilities hours before the flare eruption time.
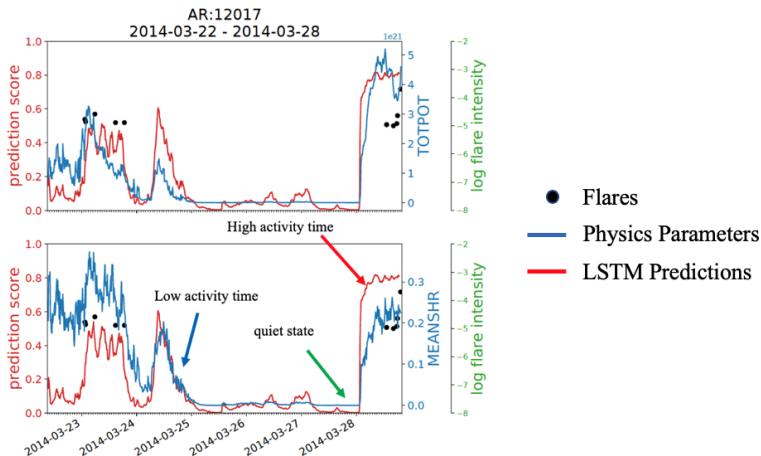

Figure: Sudden transition of predicted probability
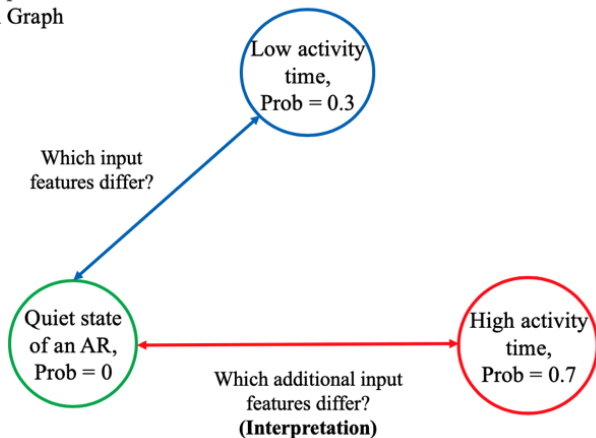
Interpretation of Fitted LSTM Model

Figure: LSTM Interpretation Conceptual Graph