CS 231N - Project Proposal

Alex Langshur (adl), Harry Mellsop (hmellsop), Collin Schlager (schlager)

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Working Title : California Wildfire Prediction using Temporal Convolutional Networks

Problem : We seek to predict wildfire incidence in California using a family of temporal convolutional architectures. The general idea is to take spatiotemporal data in the form of satellite imagery, corroborated with data from Cal Fire and use this to predict where new fires might occur ahead of time across California. Such a model could be used to apportion state resources more efficiently in the future, and ultimately allow for faster response times to wildfires, saving time, resources, and lives. Wildfires represent a substantial and on-going threat to California. In 2018 alone, wildfires caused an estimated $400 billion of damages to the California economy, according to AccuWeather. A key component of the difficulty in fighting wildfires are their spontaneity and remote nature. A model that accurately predicts hotspots for wildfires could provide forest management teams with time to mitigate an ignition event or to prepare for firefighting.

Dataset : For our dataset, we will be synthesizing time-series satellite imaging data from Google's Earth Engine with public wildfire records from Cal Fire. We will match the public wildfire records with the satellite imaging data in order to provide classification labels.

Model : We plan to build on the temporal convolutional network designs introduced by Bai et al.[1] and Wan et al.[2]. We plan to explore various permutations of these architectures such as adding self-attention or training over a latent representation of the data created by a auto-encoder. We hope to use these model architectures to leverage the temporal structure in our time-series satellite data.

Evaluation : Qualitatively, we expect to be able to predict hotspot regions in the state of California that have a high probability of a wildfire incident. Similar to a bounding box prediction algorithm, we expect to be able to outline these high-risk spatial regions on the satellite imaging data. Quantitatively, we plan to use an intersection over union loss metric to measure performance. We also plan to compare the temporal convolutional architectures with standard convolutional architectures as a form of a baseline.

Further Reading : We plan to research temporal convolution network architectures carefully ; we expect that temporal data will be enormously important to fire risk in a region (dryness over time, etc.). We also plan to continue researching existing literature for wildfire prediction models. Our research led us to California's WiFire model which predicts the spread of wildfires ; we are going see if there are relevant insights to be gleaned from this system.

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1. Bai et al., *An Empirical Evaluation of Generic Convolutional and Recurrent Networks for Sequence Modeling*, 2018. Retrieved from https ://arxiv.org/pdf/1803.01271.pdf
2. *Multivariate Temporal Convolutional Network : A Deep Neural Networks Approach for Multivariate Time Series Forecasting*, 2019. Retrieved from https ://www.mdpi.com/2079-9292/8/8/876/pdf