Wildfire Detection, Identification and Visualization

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1 Two-Branch Neural Network

Inspired by the idea that social media platforms can be used to detect and locate disasters,[1] we are seeing social media users as individual sensors to detect disasters as the same concept introduced in.[2] Based on the model of two branch neural network,[3] we design our model that consists of a LSTM network and a 3 layer Convolutional neural network to identify wildfire from crowd-souring materials including texts, photos and videos.

1.1 Data Preparation

Due to the limited time we have from the Space App Challenge, we only filtered out 1400 posts with texts, images along with geo-coordinates attached as training set from social media platforms including Twitter and Flicker about hashtags #wildfire #CaliforniaWildFire #wildfires, and averagely split them into four categories: fireman, grassland fire, fire live scenes and smoky air caused by wildfires. Meanwhile, we randomly selected 50 posts from each categories for validation purpose. For text part of our training set, we pre-process the texts with stop-words removal, case-folding and Part-of-Speech tagging to only filter out noun words by using NLTK [1], a well known Python package for Nature Language Processing. Then, we adopted word2vec embeddings to represent each word in the post as a 400-dimension vector using an existed pre-trained model for Twitter [2]. For image part of the training set, we resized each image into a new size of 158×158. Therefore, each image for the network will be a $158 \times 158 \times 3$-dimension input.

1.2 Results

After 500 iterations of training producer, the network achieved 84.27% accuracy in identifying different pre-defend categories on validation set. By associating with the coordinates of each post, we can clearly see the distribution of the wildfire posts on the map in Fgure 2.

References

1. Boulton, C. A., Shotton, H. & Williams, H. T. Using social media to detect and locate wildfires (AAAI, 2016).

2. Sakaki, T., Okazaki, M. & Matsuo, Y. Earthquake shakes twitter users: real-time event detection by social sensors. In *Proceedings of the 19th international conference on World wide web*, 851–860 (ACM, 2010).

3. Wang, L., Li, Y. & Lazebnik, S. Learning deep structure-preserving image-text embeddings. In *Proceedings of the IEEE conference on computer vision and pattern recognition*, 5005–5013 (2016).
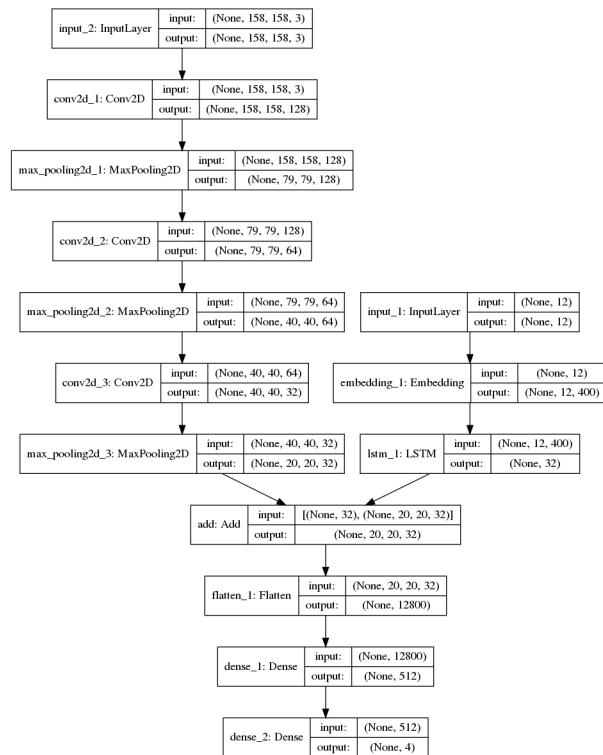
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[1] https://www.nltk.org/

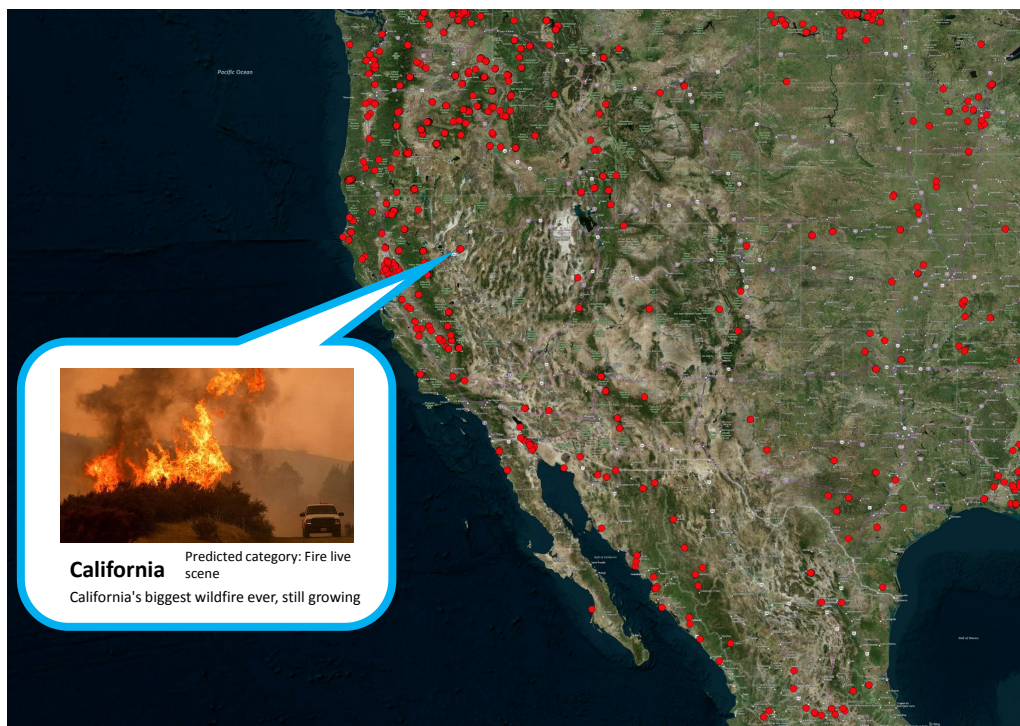[2] https://github.com/loretoparisi/word2vec-twitter

Figure 1. Two-Branch Neural Network.

Figure 2. Two-Branch Neural Network.