**Homework #2:**

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**Title of research:**

A Survey of Machine and Deep Learning in Geo-Information System (GIS)

**Interests:**

My thesis is focused on paper survey of overhead imagery processing & recognition using machine and deep learning algorithms and models, such as CNN (Convolutional Neural Network) for static images, and LSTM-RNN (Long Short-Term Memory RNN) for videos. With the AI, there are some uses in GIS:

* Some researchers use CNN to identify and classify outdoor events occurred in an overhead image (i.e, vehicular racing, marathon, etc.)
* Some researchers use LSTM-RNN to identify, classify, predict the damage of, and respond to the disasters, and analyse their post-action damage.
* In survey engineering, some researchers use CNN observe changes in land use, crop growth, and construction progresses.
* All the papers referred, may be added & updated in the future, involve GIS and Computer Vision (CV).

**Research project Description:**

According to Doshi et al, 2018 [1], We propose to identify disaster-impacted areas by comparing the change in man-made features extracted from satellite imagery. Using a pre-trained semantic segmentation model from [2] we extract man-made features, the pre- and post-event images on the “before, during and after” imagery of the event-affected area.

According to Amit et al. [3], CNN is a sequence of layers, the convolution layer (who detects features from a data image), the pooling layer (downsamples the input), and the FC layer (who classifies the features detected earlier). with ReLU as the main activation function of the network. Further explained in the section 2 of [3].

Iglovikov et al. 2017 [4], used an FC-CNN named U-NET, along with an embedded multispectral sensor, which detects frequency reflection by the objects, to detect geo-features in satellite images and yielded satisfying results.

According to Bochkovskiy et al. [5], with the help of YOLO V.4, and TensorFlow Keras, CNN’s performance in image recognition is improved. So that it would be our main CNN model in this thesis. We hope that our deep learning model, written in Python, will work as the goals above.

In Terms of video and sequence type photos (such as slideshow), however, the use of LSTM-RNN is needed. According to Fang et al. [6], LSTM is excellent at predicting flood because it could process time series data.

**References:**

[1] Doshi, J., Basu, S. and Pang, G., 2018. From satellite imagery to disaster insights. *arXiv preprint arXiv:1812.07033*.

[2] Doshi, Jigar. 2018. Residual Inception Skip Network for Binary Segmentation. Pages 216–219 of:

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[3] Amit, S.N.K.B. and Aoki, Y., 2017, September. Disaster detection from aerial imagery with convolutional neural network. In 2017 International Electronics Symposium on Knowledge Creation and Intelligent Computing (IES-KCIC) (pp. 239-245). IEEE.

[4] V. Iglovikov, S. Mushinskiy, and V. Osin, “Satellite Imagery Feature Detection using Deep Convolutional Neural Network: A Kaggle Competition,” vol. June, 2017.

[5] A. Bochkovskiy, C.-Y. Wang, and H.-Y. M. Liao, “Yolov4: Optimal speed and accuracy of object detection,” ArXiv, vol. abs/2004.10934, 2020.

[6] Fang, Z., Wang, Y., Peng, L. and Hong, H., 2020. Predicting flood susceptibility using LSTM neural networks. *Journal of Hydrology*, [online] p.125734. Available at: <https://doi.org/10.1016/j.jhydrol.2020.125734> [Accessed 18 April 2021].