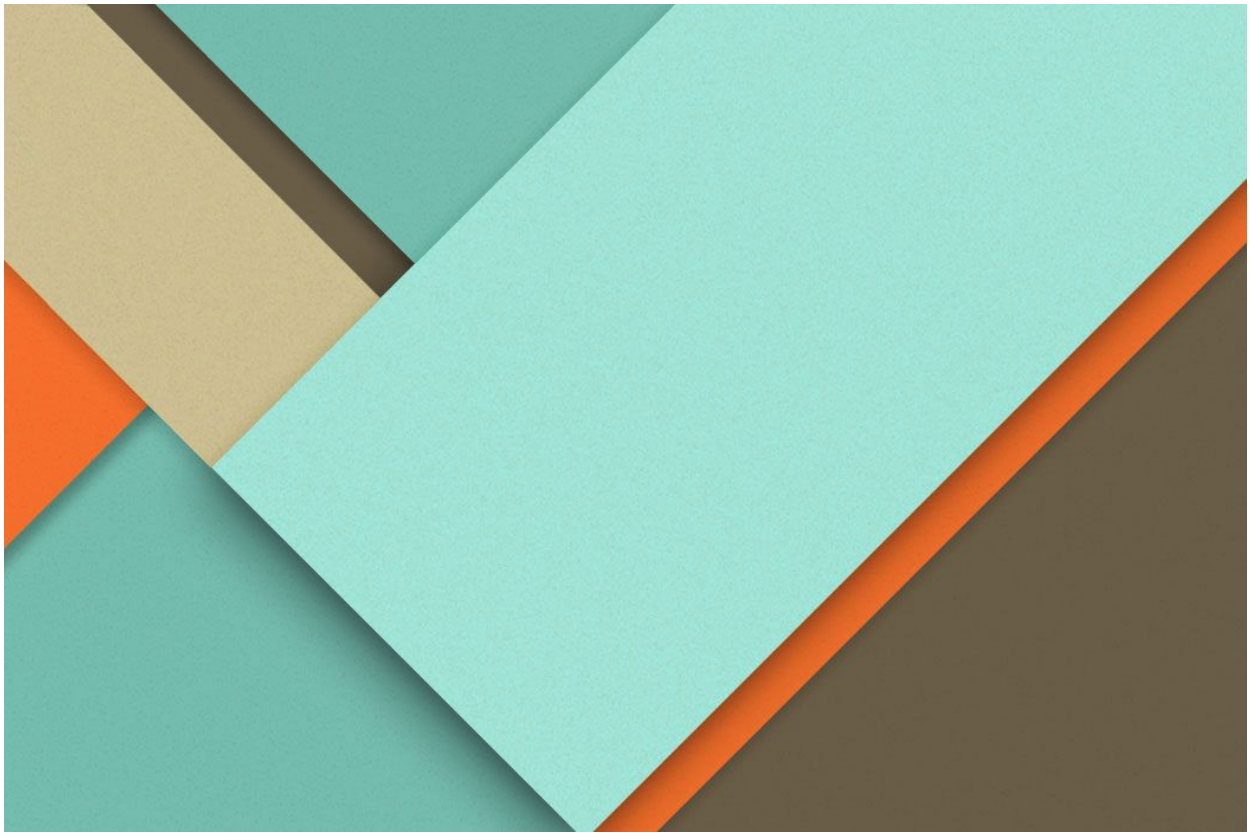

Deep Anomaly

Course Project for the course CS 763- Computer Vision, Spring 2019

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Abstract

Analysis of human activity in crowded scenes is one of the most challenging tasks in computer vision because video monitoring involves events which require follow-up but have a very low probability. On top of that, the complexity of normal crowd behaviors makes the task even more complicated. It also has a lot of applications in security, surveillance and public safety. Traditional approaches were built on concepts like the Social Force Model (taken from Sociology and Behavioural Science) used by Mehran et al. in *'Abnormal Crowd Behavior Detection using Social Force Model'* or hierarchy of MDT models that was used by Li et al. in 'Anomaly Detection and Localization in Crowded Scenes'. More recently Deep Learning based approaches which are end-to-end trainable have been proposed. The most successful out of these is the one proposed by M. Sabokrou, M. Fayyaz, M. Fathy, Z. Moayed and R. Klette in their paper *'Deep-Anomaly: Fully Convolutional Neural Network for Fast Anomaly Detection in Crowded Scenes'*. In this project, we plan to implement this paper since no public implementation of this paper is available online. This approach would use Fully Convolutional Neural Networks and temporal data. Transfer learning is also used to transfer a pre-trained supervised FCN into an unsupervised FCN, to ensure the detection of global anomalies in the scene. In addition to this, the focus would be on the performance, not only in terms of speed but also in terms of accuracy, since the application of this project requires real-time processing capabilities. The proposed implementation is expected to outperform existing methods in terms of accuracy related to the detection and localization of anomalies.

Datasets being used

1. UCSD Anomaly Detection Dataset
   http://www.svcl.ucsd.edu/projects/anomaly/dataset.html
2. UCF CRSCV Abnormal Crowd Behaviour Detection Datasets (2 Datasets)
   http://crcv.ucf.edu/projects/Abnormal_Crowd/#Downloads
3. This webpage has links to 8 different Datasets (Traffic- Train, Belleview, Boat-Sea, etc.). We plan to use at least the Subway-Exit dataset mentioned there, but we might use others as well, depending on the availability of time
   http://vision.eecs.yorku.ca/research/anomalous-behaviour-data/

Final Deliverables

Plan A

As mentioned in the abstract, we propose to implement the paper *'Deep-Anomaly: Fully Convolutional Neural Network for Fast Anomaly Detection in Crowded Scenes' by* M. Sabokrou, M. Fayyaz, M. Fathy, Z. Moayed and R. Klette. We also plan to test and train our implementation on not only the datasets used by them but some additional datasets as well (as mentioned in the section above). We are expecting to achieve accuracies close to those mentioned in the paper, and our focus would also be on the speed of our model since the implementation needs to work in real time to have any application. We plan to use this paper among the existing literature because this is the most recent one out of all the other papers and its performance beats the rest. We plan to train on at least three datasets (the paper used two). Thus are tasks (in order) include:

- Getting a thorough understanding of the paper.
- Procuring the datasets and preparing the architecture/ data pipeline required for running the training.
- Performing data-preprocessing if required.
- Completing the basic code for the implementation.
- Training on at least 3 datasets.
- Testing the implementation.
- Repeating the previous 2 sets until 'nice' results are obtained.
- Training on other datasets (if time permits).
- Evaluating the project.
- Preparing a report.
- Preparing a presentation.

Plan B

Although we are very confident of our Plan A, if we are, for some reason, not able to achieve that, then we'd consider implementing *'Anomaly Detection and Localization in Crowded Scenes'* by W. Li, V. Mahadevan, and N. Vasconcelos. The reason for keeping this paper as a Plan B is because this paper has been around for a while and is well cited, so finding our way around would be easier than Plan A and lesser heuristics and hit-and-trial approaches would be required to train this. The reason for preferring this paper over the others (especially over *'Abnormal Crowd Behavior Detection using Social Force Model'* by R.

Mehran, A. Oyama, and M. Shah which was a contender for the spot) is that this is more recent and has a wider scope than the other papers (both- the presence of abrupt movements of a crowd and presence of strange entities, are detected by this model).

Optional

Optionally, if time permits, we would like to train whichever model we build on other datasets as well (as mentioned in the section above).

Mid-Term Deliverables

We plan to complete the following before the 2nd week of March:

- Getting a thorough understanding of the paper.
- Procuring the datasets and preparing the architecture/ data pipeline required for running the training.
- Performing data-preprocessing if required.
- Completing the basic code for the implementation.