Technology to Licence T-21-021

ULfAD (Unsupervised Learning of Anomaly Detection)

Overview

Researchers at TU Dublin have developed ULfAD (Unsupervised Learning of Anomaly Detection) to detect previously unseen rare objects or events without any prior knowledge about these.

Normally, the percentage of anomalies in a dataset is small or sometimes highly imbalanced e.g. less than 1%. Since anomalies are rare and unknown to the user at training time, anomaly detection in most cases boils down to the problem of modelling the normal data distribution and defining a measurement in this space in order to classify samples as anomalous or normal. In high-dimensional data such as images, distances in the original space quickly lose descriptive power (the curse of dimensionality) and mapping to some more suitable space is required.

ULfAD presents unsupervised deep learning approaches used for fraud detection and intrusion detection among anomaly detection cases. These approaches applied to the structured data are Self-Organizing Map (SOM), Autoencoder and Deep Autoencoding Gaussian Mixture Model (DAGMM) respectively.

ULfAD can also compare these approaches on each case by evaluation metrics such as F1-score, precision and recall and then it can suggest which algorithm is more accurate or better to use for each of the two cases.

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Advantages

ULfAD presents state-of-the-art solutions for anomaly detection cases by using unsupervised deep learning techniques, compares these techniques over intrusion detection and fraud detection by predicting anomalies and also displays indexes of true estimates. First technique of these is SOM, which is a standalone or with combination with other clustering techniques. It is a great tool not only as a data dimensionality reduction method but also as a scheme useful to visualize/detect issues or incidents on the data. Second one is Autoencoders which is quite popular in unsupervised neural network family and used on various state-of-the-art approaches in anomaly detection domain. Third one is DAGMM which is a hybrid model constructed together with Gaussian Mixture Model and Autoencoder.

Opportunity

The tool is targeted to demonstrate to any company or organization who want to understand how unsupervised neural networks can detect anomalies and what kind of visualizations they can provide to the end users such as two-dimensional map output of SOM. This can guide the end users in understanding anomalies in a case such as credit card application, machine sensor monitoring. Anomalies might cause any type cost to the companies such as profit loss, production loss. Hence, ULfAD can support them to prevent any possible anomaly in the future, depending on the case.

Stage of Development

TU Dublin is seeking commercial partners to assist in bringing this technology to market.

Contact Us

See how
TU Dublin
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can work with
your business.

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