A Novel Approach of Slope Failure Analysis via Noise Injected Data for Representation Learning K-means Clustering and Convolutional Neural Networks

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The analysis of slope failures in a treacherous environment is an important aspect of surveying plots of land. As a result, tools such as drones are used to take images and create 3D models of the survey site. However, creating the 3D model requires heavy computing power to complete; even on a capable machine, models can take up to a day to complete. Therefore, a more real-time approach is proposed with the usage of convolutional neural networks (CNN), transfer learning, and object detection. Techniques used in facial identification tasks such as representation learning and k-means clustering were used to analyze and classify slope failures. By collecting soil of different types and measuring the weight, moisture, and crack appearance and creating a dataset from this, a CNN was trained to identify these features in a survey. Representation learning will then be used to create a point of data compared to the dataset. Additionally, to increase the size of the dataset and in order to simulate real world data, noise over noise was introduced into the photos. By measuring the Euclidean distance of a subject of analysis relative to the centroid of the dataset cluster, slope failure classification is possible. Furthermore, k-means clustering is used to make a more accurate classification. Equipped onto a survey drone, civil engineers can run safer real-time analysis. Lastly, by using representation learning and embeddings, the computational requirements are reduced and an embedded system for drones is more realistic.

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