6.5 GEOCLUSTER-EXPERTNET: A PROPOSED MODEL INTEGRATING UNSUPERVISED LEARNING WITH EXPERT FOR OPTIMAL GEOTHERMAL DRILLING

O. Teke[1*]

[1]Lecturer, Computer Sciences Department, Manisa Celal Bayar Üniversitesi, Manisa, Turkey
**Corresponding author e-mail: orkun.teke@cbu.edu.tr*

ABSTRACT

"GeoCluster-ExpertNet" is an advanced model proposal for determining the most suitable locations for geothermal energy drilling. The basis of this model is the integration of geological, seismic, historical drilling and environmental datasets. However, one of the important innovation of this model comes from processing the data with two different clustering methods, K-means and DBSCAN, respectively. First, the K-means clustering method is used to determine the class characteristics of the data. This step defines the overall structure of the dataset and its main groups. Then, a density-based clustering with “Density-Based Spatial Clustering of Applications with Noise (DBSCAN)” is performed on these clusters, thus detecting more specific and intense geothermal activity zones. This two-step approach allows the model to provide more precise and comprehensive recommendations. Data visualization techniques with “t-Distributed Stochastic Neighbour Embedding (t-SNE)” are combined with these dense vector representations, the model's drilling recommendations are based on both computer computations and deep semantic connections. However, the real innovation of the model lies in the deep integration of neural network embedding techniques. These embedding techniques transform large and heterogeneous datasets into denser and semantically rich vector representations. This allows the model to capture relationships more effectively between complex data structures. For example, the relationship of a particular geological formation to seismic activity can be more clearly understood through these embedding vectors. When density-based spatial clustering with and finally, thanks to its adaptive learning mechanism, “GeoCluster-ExpertNet” continuously updates itself with new data and optimizes these embedding vectors based on real-world feedback. This integrative approach enables a more informed and effective determination of geothermal drilling strategies. Model architecture presented in Figure 1.

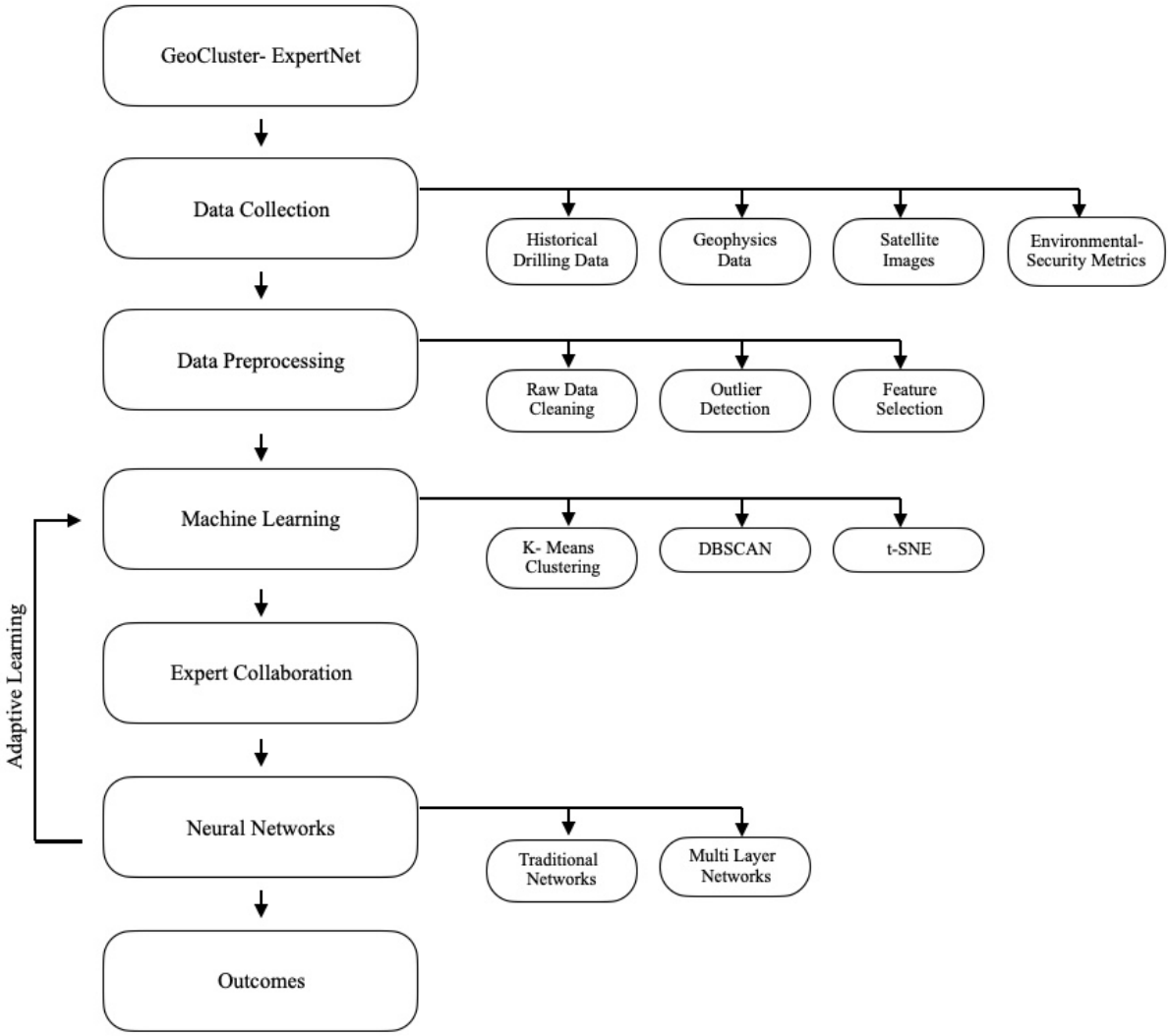

Figure1 Model Architecture

KEYWORDS : Geothermal Energy, Geothermal Drilling, Machine Learning, Unsupervised Learning, Neural Networks