Fraud Detection Using an Autoencoder and Variational Autoencoder

Importing Data:

1. We used pandas for reading the card transaction csv file

Pre-processing data:

1. We have transformed Time and Amount using logarithmic transformation and named it as log_time and log_amount.
2. We dropped the original Time and Amount.
3. We normalized all the remaining features excluding ‘Class’ using Min-Max scaling and scaled data in range between 0 and 1.
4. We create `fraud_data` and `non_fraud_data` based on 'Class' values.
5. We split the X_test and X_train data set for test and train purposes.

Defining the Autoencoder

1. Set Random Seed
    a. We fix the random seed to 42.
2. Define Model Architecture
    a. We initialize the autoencoders as sequential models.
    b. We define 2 dense layers with ReLU activation function.
        - The first dense layer has 14 nodes.
        - The second dense layer has 7 nodes.
    c. We add 2 more dense layer to reconstruct the input.
        - The third dense layer, with 14 nodes and ReLU activation, acts as a part of the decoder.
        - The last dense layer has the same number of nodes as input features and uses sigmoid activation, ensuring output values between 0 and 1.
3. Compile the Model
    a. We configure the model for training.
        - We use Adam optimizer for training.
        - We use Mean Squared Error (MSE) for the loss function.

Defining the Variational - Autoencoder

2. Define Model Architecture
    a. We initialize the autoencoders as sequential models.

    Encoder Architecture:

    d. We define 2 dense layers with ReLU activation function.
        - The first layer reduces the input size from 30 to 20.
        - The second layer further reduces it from 20 to 16.

    Decoder Architecture:

    Two linear layers are used to upscale the input.
        - For the first size from 8 to 16
        - For next layer to 20,
        - And then finally back to 30.

3. Compile the Model
    a. We configure the model for training.
        - We use Adam optimizer for training.
        - We use Mean Squared Error (MSE) for the loss function.

Plotting the Results : We plot F1 score using autoencoders and variational autoencoders.