A black background with white text

AI-generated content may be incorrect. A black background with green and grey text

AI-generated content may be incorrect.

# **6CS012 – Artificial Intelligence and Machine Learning**

**Assignment - III**

University Id: 2330520 Group: L6CG22

Tutor: Aatiz Ghimire

Submitted by: Shrota Ghimire

Submitted on: 20th May, 2025

1. You are a Data Scientist at eSewa, Nepal’s leading digital payment platform.

• Identify two high - impact areas where unsupervised learning could add significant business value.

• For each area:

* Define the problem clearly (e.g., customer behavior clustering, fraud pattern detection).
* Propose a specific unsupervised learning approach (e.g., clustering, anomaly detection, dimensionality reduction) and recommend one or more algorithms (e.g. K-Means, DBSCAN, Autoencoders).
* Briefly explain how the outputs from these models can be integrated into eSewa’sproducts or services to drive business decisions.

**Answer:**

Since it is the top digital payment service in Nepal, eSewa could improve its customer service and internal operations with unsupervised learning. Two high-impact areas are:

**a**. **Customer Behavior Clustering**

**Problem:** eSewa is used by numerous people with various kinds of spending styles. While some individuals use it sometimes for simple transactions, some others depend on it day-to-day for managing their money. If similar users are identified and grouped together, eSewa will be able to enhance its roadmap, customize advertising campaigns, and ease the onboarding step.

**Approach:** Because of K-Means or GMM clustering, users’ data on transaction frequency, how much they spend, the type of payment, and time of transactions can be grouped. They gather customers with similar behaviors, so they are the perfect way to uncover customer habits that are not obvious to everyone.

**Integration:** Using user groups organized by their frequency, how much they spend, what they pay for, and when they use the service, eSewa can organize special marketing efforts. An example is that those who use their wallets less might receive a top-up, while regular users can gain loyalty awards. As a result of personalization, users are encouraged to come back and interact more with your product.

**b. Fraud Pattern Detection**

**Problem:** Chances of fraud can harm both the credibility and the security of eSewa’s finances. Frauds can show up with unusual behavior that is not obvious at the beginning.

**Approach:** It is best to use Isolation Forest, Autoencoders, or DBSCAN for detecting anomalies.

**Integration:** They can look at live data streams and identify anything that looks suspect (like a big jump in the amount of a transaction or several unsuccessful login attempts). This way of detecting fraud with anomaly scores can allow the team to catch instances of fraud fast and avoid limiting their search to just the set of rules. The system can learn and respond to new kinds of fraud automatically.

With these unsupervised learning approaches, eSewa can achieve both personalized and secure user experiences, which help increase customer satisfaction and minimize risks related to finances.

2. Overfitting is a common challenge in deep learning models.

• Describe at least two techniques commonly used to prevent or reduce overfitting.

• For each method:

* Briefly explain how it works.
* Provide a practical example of how it would be applied in a real-world deep learning project.

**Answer:**

Generally, deep learning models can do well in training but fail to work well when presented with data they have not seen before because of overfitting. Dropout and Early Stopping are strong methods to deal with overfitting.

1. **Dropout**

Each time the network is trained, dropout shuts off some neurons to prevent the network from becoming dependent on a few neurons, making it learn stronger and universal features. It prevents models from adapting to each other, resulting in better performance.

Example: To prevent a CNN from learning too much from the training images in a handwriting recognition project, dropout can be applied at a 0.5 rate to the dense layers. Rather, it learns many different and dependable features that work well on unfamiliar images.

1. **Early Stopping**

When training on a validation set, early stopping stops the process as soon as the model’s performance does not improve any further, making sure it does not learn more than what is needed from the data.

Example: With an LSTM in a sentiment analysis task, using early stopping prevents the model from getting caught up in the details of each review. This way, we continue to keep the model accurate when used on new data.

Using these approaches helps to ensure that the models are predictable and safe whenever they are deployed.

3. Explain the fundamental differences between a Convolutional Neural Network (CNN) and a Recurrent Neural Network (RNN).

* Provide examples of scenarios where one would be more suitable than the other.

• Briefly discuss common challenges faced during the training of deep learning models

* Provide possible solutions or techniques to address these.

**Answer:**

CNNs and RNNs are two popular deep learning architectures that are used for different things depending on the structure of the data.

CNNs are built to work with data that is laid out in a grid, including images. They apply convolutional layers to spot differences in edges, textures, and shapes in different parts of an image, so they are suitable for image recognition, finding objects, and tasks related to medical images.

MNIST and face identification in security systems are problems where CNNs perform very well.

Unlike CNNs, RNNs can deal with data that appears in a sequence. They recall earlier inputs, which makes it possible for them to learn about time sequences. Therefore, such algorithms are prepared for time-series forecasting, speech recognition, and natural language processing.

Using RNNs, you can accurately predict how the stock market will change, or study long-term market trends based on reviews and conversations.

The Main Problems That Deep Learning Trainers Face:

* **Vanishing Gradients:** As gradients become smaller during the backpropagation process in deep networks, it leads to problems in learning for the first layers.

*Solution:* If you use RNNs, make sure to use LSTM or GRU architectures, or use batch normalization to rectify and increase the speed of training.

* **Overfitting:** A model that only remembers what was taught will not do well on new data.

*Solution:* Using dropout, data augmentation, or early stopping to make your model perform better when it has not seen the training data before.

The correct design and trusted training allow deep learning models to produce good results and high reliability in various tasks.