**ANA680 AI Implementation**

**National University**

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**Module 1 Assignment 2: Design a Three-Layered ANN Classifier**

**Executive Summary**

This project applies a three-layered Artificial Neural Network (ANN) to predict customer churn using the Churn\_Modelling.csv dataset, which includes ~10,000 customer records with features such as age, balance, tenure, and geography.

**ANN Design:**

* Input layer with 11 features (after encoding and scaling)
* Two hidden layers with ReLU activation
* Output layer with sigmoid activation (for binary classification)
* Compiled with Adam optimizer and binary cross-entropy loss
* Early stopping was used to prevent overfitting

**Model Evaluation:**

* **Accuracy**: **0.8565**  
  This means the model correctly predicted whether a customer churned or not **85.65%** of the time on unseen test data.
* **Confusion Matrix**: [[1502 93] [ 195 210]]
  + **True Negatives (1502)**: Customers correctly predicted to stay
  + **False Positives (93)**: Customers incorrectly predicted to churn
  + **False Negatives (195)**: Customers who churned but were predicted to stay
  + **True Positives (210)**: Customers correctly predicted to churn

The model is slightly more conservative in predicting churn, which may reduce unnecessary customer outreach but could miss some at-risk customers.

**Feature Importance:**

Using SHAP (SHapley Additive exPlanations), to identify the following most influential features:

* **Age** had the highest impact: older customers were more likely to leave.
* **IsActiveMember**: less active customers had higher churn rates.
* **Geography\_Germany**: customers in Germany showed more volatility.

**Deliverables:**

* Python source code
* Output files: predictions, SHAP plots, training logs
* GitHub repository with README and all code artifacts