

Cairo University - Faculty of Engineering  
Computer Engineering Department  
CMP4040 – Machine Intelligence  
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## **Machine Learning Project Proposal**

### **Team #12**

Team members:

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## First Idea: **Employee Attrition Prediction**

### **Problem Definition and Motivation:**

Employee attrition, or the rate at which employees leave a company, is a significant concern for organizations due to the high costs associated with hiring and training new employees. According to recent data, the average cost per hire rose to \$4,700 in 2023. For specialized positions such as cybersecurity, engineering, or nursing, the cost per hire can be even higher, reaching up to \$28,329 for executive positions. These costs, combined with factors such as ultra-low unemployment rates and an aging workforce, highlight the importance of predicting and mitigating employee attrition.

[ source: <https://toggl.com/blog/cost-of-hiring-an-employee> ]

By developing a machine learning model that can predict employee attrition, organizations can take proactive measures to retain valuable talent and reduce turnover costs. This project aims to leverage machine learning techniques to analyze factors such as job satisfaction, salary, work-life balance, etc., and predict which employees are most likely to leave the company. By doing so, organizations can optimize their hiring and retention strategies, ultimately reducing the financial burden of employee turnover.

### **Evaluation Metrics:**

The performance of our machine learning model will be evaluated using metrics such as accuracy, precision, recall, and F1-score. Given the high costs associated with employee attrition, we will prioritize recall as the most important metric. Maximizing recall will help us identify the minimum number of false negatives (employees who may potentially leave the company but are not classified as such), thus reducing the risk of losing valuable talent. However, we also recognize the importance of precision to avoid a high number of false positives (employees who are not likely to leave but are classified as such), which could lead to unnecessary intervention strategies. Therefore, we will aim to strike a balance between recall and precision to optimize the performance of our model.

### **Dataset and References:**

We will use a publicly available dataset on employee attrition, such as the [IBM HR Analytics Employee Attrition & Performance dataset](#), which contains information about employees' demographics, job role, satisfaction levels, etc.

We will also refer to relevant research papers and articles on employee attrition prediction for guidance and insights.

(1) [Predicting Employee Attrition Using Machine Learning Technique](#)

(2) [Predicting Employee Attrition Using Machine Learning Approaches](#)

## Second Idea: Demand Forecasting

### **Problem Definition and Motivation:**

Demand forecasting is a critical task for businesses to effectively manage inventory, production, and supply chain operations. Accurate demand forecasts can help reduce costs, minimize stockouts, and improve customer satisfaction. This project aims to develop a machine learning model that can predict the demand for a product or service based on historical sales data, pricing information, and other relevant factors. By leveraging machine learning techniques, we aim to improve the accuracy of demand forecasts and enable businesses to make better-informed decisions.

### **Evaluation Metrics:**

The performance of our demand forecasting model will be evaluated using the following metrics: accuracy, F1-score, precision, sensitivity, mean percentage error (MPE), and mean absolute percentage error (MAPE). These metrics will help us assess the accuracy and reliability of our model's predictions.

### **Dataset and References:**

We will use a publicly available [dataset](#) on demand forecasting on Kaggle, which contains information about sales transactions, product attributes, and customer demographics. Additionally, we will refer to relevant research papers and articles on demand forecasting techniques to guide our approach and methodology.

(1) [Comparison Study: Product Demand Forecasting with Machine Learning for Shop](#)