

## Bias-Aware Machine Learning for Ethical Hiring

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Github Link : <https://github.com/Shashwatshah02/Singularity---Hiring-Employees>

### Project Overview

With the increasing adoption of Artificial Intelligence in recruitment, machine learning models are widely used to screen resumes, predict employability, and assist hiring decisions. While these systems improve efficiency, they often inherit biases present in historical data, leading to unfair outcomes for certain demographic groups.

This project focuses on building an ethical and bias-aware machine learning pipeline for predicting employability while actively addressing gender imbalance in hiring data.

### Problem Formulation

The task is formulated as a binary classification problem, where the objective is to predict whether a candidate is employed based on professional, educational, and demographic attributes. A major challenge addressed in this project is dataset bias, which can cause models to favor majority groups and produce unfair predictions.

### Dataset Description

The dataset consists of over 73,000 job applicants and includes features such as age, education level, gender, country, years of coding experience, professional experience, previous salary, and number of technical skills. Initial analysis revealed a strong gender imbalance in the data.

### Approach and Methodology

The workflow includes data cleaning, feature encoding, handling missing values, and geographic segmentation. To mitigate bias, the imbalanced-learn library was used to rebalance the dataset, ensuring equal representation across genders before training.

Multiple machine learning models were implemented, including Logistic Regression, Decision Tree, Random Forest, K-Nearest Neighbors, and a Sequential Neural Network.

### Evaluation and Results

Model performance was evaluated using Area Under the ROC Curve (AUC). Results showed consistent improvement across all models after bias mitigation. The Sequential Neural Network showed the most significant improvement, highlighting the importance of fairness-aware preprocessing.

## **Conclusion**

This project demonstrates that ethical considerations in machine learning can be practically implemented through bias mitigation techniques. Addressing bias not only improves fairness but also enhances overall model performance, making AI-driven hiring systems more reliable and inclusive.

## **Feedback Needed**

Based on the current project, I personally like this domain especially heading towards singularity. I would really like to pursue this project ahead and move towards writing a research paper in the same domain. If possible could you please provide feedback based on this. I have been working on this project solo based on interest conflicts with other members.

Thank You

Shashwat Shah