Group project

Loan Approval System with Bias Mitigation

- Students will work on a **loan approval prediction task**, where they will develop a model that predicts whether a loan should be approved or not based on various features.

- They will apply different bias mitigation techniques (pre-processing, in-processing, and post-processing) to ensure fairness in the loan approval system across different demographic groups.

- At the end of the project, students will compare the model's fairness and accuracy before and after applying these techniques.

Dataset (available on blackboard)

- **Features :**

  - **Demographics**: Gender, Married, Dependents, Education, Self_Employed, Property_Area

  - **Financial information**: ApplicantIncome, CoapplicantIncome, Credit_History

  - **Loan details**: LoanAmount, Loan_Amount_Term

  - **Target variable**: Loan_Status

- CSV format

Project tasks

- Data Exploration, Pre-processing and basic visualizations
  - Identify sensitive attributes
  - Choose your fairness metric
  - Analyze biases in the data
- Model training (baseline model)
  - Train a baseline
  - Evaluate the performance and the fairness
- Bias mitigation
  - Apply bias mitigation techniques (pre-processing, in-processing and post-processing)
  - Evaluate the performance and the fairness
- Fairness evaluation
  - Compare the fairness metrics for different mitigation techniques

Final deliverable

One jupyter notebook per group with your code and analysis

- The **code** should include:
  - Data cleaning and preprocessing steps.
  - Model training, evaluation, and comparison of baseline vs. biased model.
  - Application of bias mitigation techniques (pre-processing, in-processing, and post-processing).
  - Calculation of fairness metrics.
- The **analysis** should be integrated within the Jupyter Notebook as markdown cells (with visualizations), covering:
  - Data exploration and potential biases identified.
  - Fairness issues in the baseline model.
  - Impact of each bias mitigation technique on fairness and accuracy.
  - Visualizations of fairness metrics before and after applying bias mitigation.
  - Key trade-offs and final recommendations for real-world applications.
- ***Make sure the code is well-commented to explain the rationale behind each step.***

Oral presentation

- The situation : imagine you are in front of a client that got its loan denied. You need to explain to them how your algorithm work and why it is fair.

- Your presentation should include :
  - Overview of the project: the problem, dataset, and goals.
  - Summary of model training results (accuracy and fairness metrics).
  - A clear discussion of each bias mitigation technique applied (pre-processing, in-processing, post-processing).
  - Visualizations comparing fairness before and after applying each technique.
  - Trade-offs between fairness and accuracy, and final recommendations.
  - Discussion about the importance of fairness in this use case.

- Each member of the team should present.

- You have 10 min per group : 8 min presentation + 2 min Q&A