Q1. A company develops a computer vision model to classify job applicants based on video interviews. The model analyzes facial expressions and speaking patterns to assess a candidate's suitability. However, it is discovered that the model performs significantly better for male candidates than female candidates because the dataset contains more videos of men. Gender is a protected attribute that is unintentionally influencing the model's decisions.

Since collecting more data is not an option, how can data augmentation be used to balance the dataset and ensure that gender does not unfairly impact the classification results?

Answer:

To balance the dataset using data augmentation, the following techniques can be applied:

1. Synthetic Data Generation (Deep Learning-Based Augmentation)

Use Generative Adversarial Networks (GANs) to generate realistic images of female candidates to balance the dataset.

Use Style Transfer to modify lighting conditions and facial textures to create more diverse representations.

2. Image Transformations on Underrepresented Group

Apply transformations such as rotation, flipping, scaling, blurring, and color jittering specifically to female candidate images to increase their representation in the dataset.

3. Voice and Expression Augmentation

If the model also considers audio, use voice pitch shifting and speed variations to augment female candidate audio data.

Q2. Should a learning-based or model-based approach be used in each of the following case? Justify your answer with max two bullet points.

a. A financial institution needs an AI-driven auditable document verification system to detect forgeries in official government-issued IDs.

Answer: Model-Based

Rule-based pattern matching and security feature detection (e.g., holograms, watermarks, and microprinting analysis) provide an interpretable and auditable system.

Deep learning models act as black boxes, making it hard to explain why an ID was flagged as fraudulent.

Regulatory bodies may require a transparent decision-making process.