Q3 Fairness

Throughout the test, the results show we cannot enforce the sufficiency and separation at the same time.

Case 1: Sufficiency hold but not Separation

Y = Hypertension
C = Hyperlipidemia
A = Gender

  - Sufficient Check:

P(Y|C,A) = P(Y|C)

P(Hypertension=Yes | Hyperlipidemia=Yes, Gender=Male) = 0.5560581928250615

P(Hypertension=Yes | Hyperlipidemia=Yes) = 0.5560581928250615

so the sufficient is satisfied.

  - Separation Check:

P(C|Y,A) = P(C|Y)

P(Hyperlipidemia=Yes | Hypertension=Yes, Gender=Male) = 0.5001088390530727

P(Hyperlipidemia=Yes | Hypertension=Yes) = 0.4639580370746129

so the separation is not satisfied.

Case 2: Separation holds but not Sufficient

Y = Hyperlipidemia
C = Vegetables
A = Gender

  - Sufficient Check:

P(Y|C,A) = P(Y|C)

P(Hyperlipidemia=Yes | Vegetables='<400g/d', Gender=Male) = 0.6168907767803194

P(Hyperlipidemia=Yes | Vegetables='<400g/d') = 0.5821287241184987

so the sufficient not is satisfied.

  - Separation Check:

P(C|Y,A) = P(C|Y)

P(Vegetables='<400g/d' | Hyperlipidemia=Yes, Gender=Male) = 0.5790000000000001

P(Vegetables='<400g/d' | Hyperlipidemia=Yes) = 0.5790000000000001

so the separation is satisfied.

In conclusion, we cannot enforce the sufficiency and separation at the same time