d. Documentation of Limitations and Proposed Solutions:

    - Document any limitations, challenges, and proposed solutions encountered during the project.

(1) Class imbalance (churners ≈ 27%, non-churners ≈ 73%)
- **Problem:** The model might overlook Churners because they are a minority.
- **Fix:** Use segment-specific thresholds (e.g., a lower cutoff for Cluster 0), track PR-AUC, default to the F1-optimal threshold, and use class weights.

(1) Limited features (due to source data)
- **Problem:** Predictive lift is limited because behavioral and time-window fields are absent from our initial database.
- **Fix (with better data):** extend data collection to include payment history, support tickets/complaints, and usage for 30/60/90 days. After those histories are available, create rolling characteristics (volatility, deltas, and levels).

(2) Tuning time/cost
- **Problem:** Hyperband trials can be slow and block iteration.
- **Fix:** Cap trials/epochs, keep EarlyStopping on, use GPU/mixed precision, schedule runs off-peak, and when rushed, reuse last good hyperparameters.

(3) Explainability & trust
- **Problem**: To many people, the ANN model looks like a "black box" — they can't see how it makes decisions.
- **Fix**: Give simple reasons for why each customer group is at risk, highlight the main factors that influence predictions, and share a one-page summary showing what data was used, how well the model works, its limits, and when it might need updates.

(4) Privacy & outreach compliance
- **Problem**: Reaching out to customers too often, or in the wrong way, can hurt satisfaction and lead to complaints.
- **Fix**: Only collect the info you truly need, protect personal data, limit how many times you contact or discount customers, and keep track of feedback. If issues show up, scale back quickly.