

SHEEP VERIFICATION

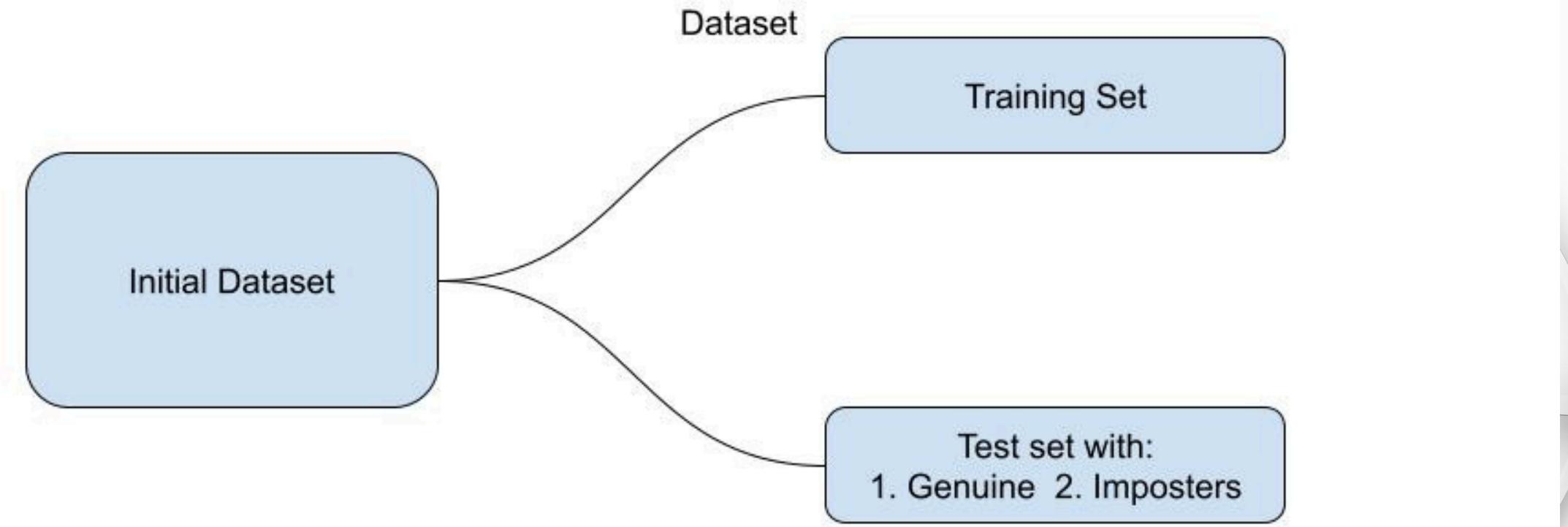
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Dataset:

Train/Test Split

- Training set: 80% of (for detector + embedding-model training)
- Test set: 20% of images, organized into:
 - Genuine pairs: same-ID probe vs. gallery
 - Impostor pairs: different-ID probe vs. gallery

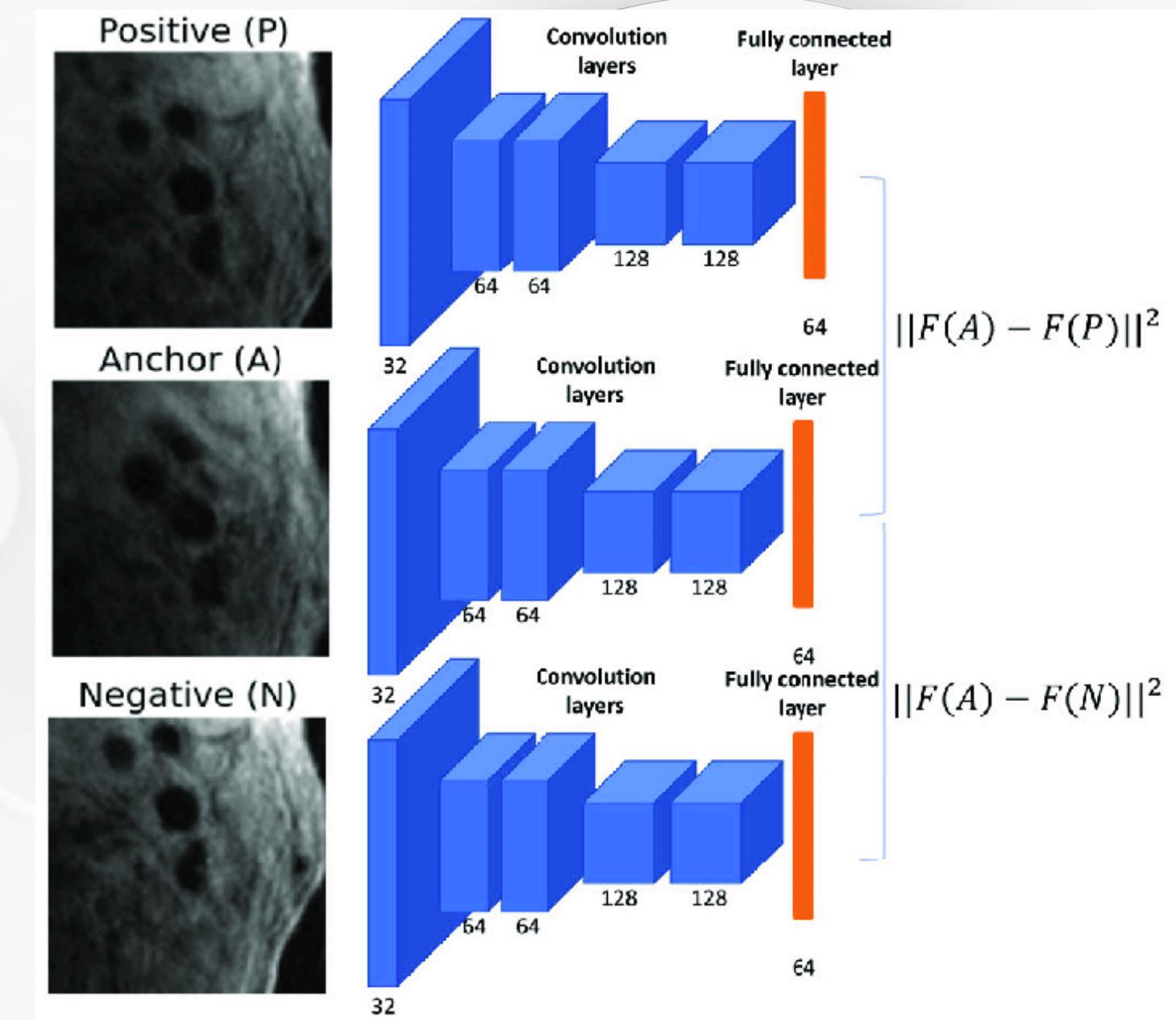


Face Detection Using YOLOv8:

- YOLOv8 Detector
 - Pre-trained on a subset of 200 Self Annotated sheep faces.
 - Fast, real-time bounding-box output
- Fallback Strategy
 - If no face box detected → crop full image to preserve data
- Why?
 - Ensures every image yields an embedding, even under occlusion or extreme poses
 - Balances precision (face-only) vs. recall (whole-image)

Embedding Extraction :

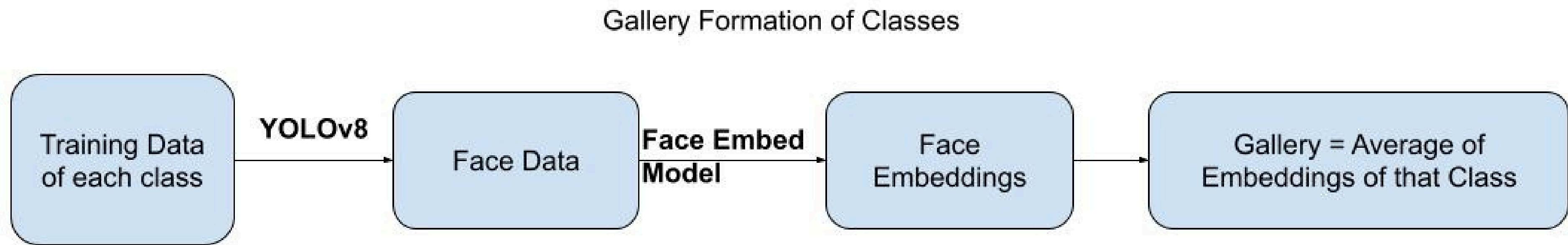
- ResNet + Triplet Loss
 - Backbone: ResNet-50 pre-trained on ImageNet, fine-tuned with triplet-loss on our sheep dataset
 - Embedding vector: 128-dimensional float array per face
- Triplet-Loss Training
 - Anchor: one image of sheep i
 - Positive: another image of sheep i
 - Negative: image of sheep $j \neq i$
 - Loss encourages embeddings of same sheep to be closer than those of different sheep



Gallery Formation:

- Per-Sheep Centroid
 - a. Extract embeddings for all training images of sheep i
 - b. Compute mean vector:
$$g_i = \frac{1}{N_i} \sum_{k=1}^{N_i} e_{ik}$$
 - a. Store $\{g_i\}$ as the gallery reference
- Advantages
 - Reduces noise from outlier images
 - Single vector per sheep → O(1) lookup time per comparison

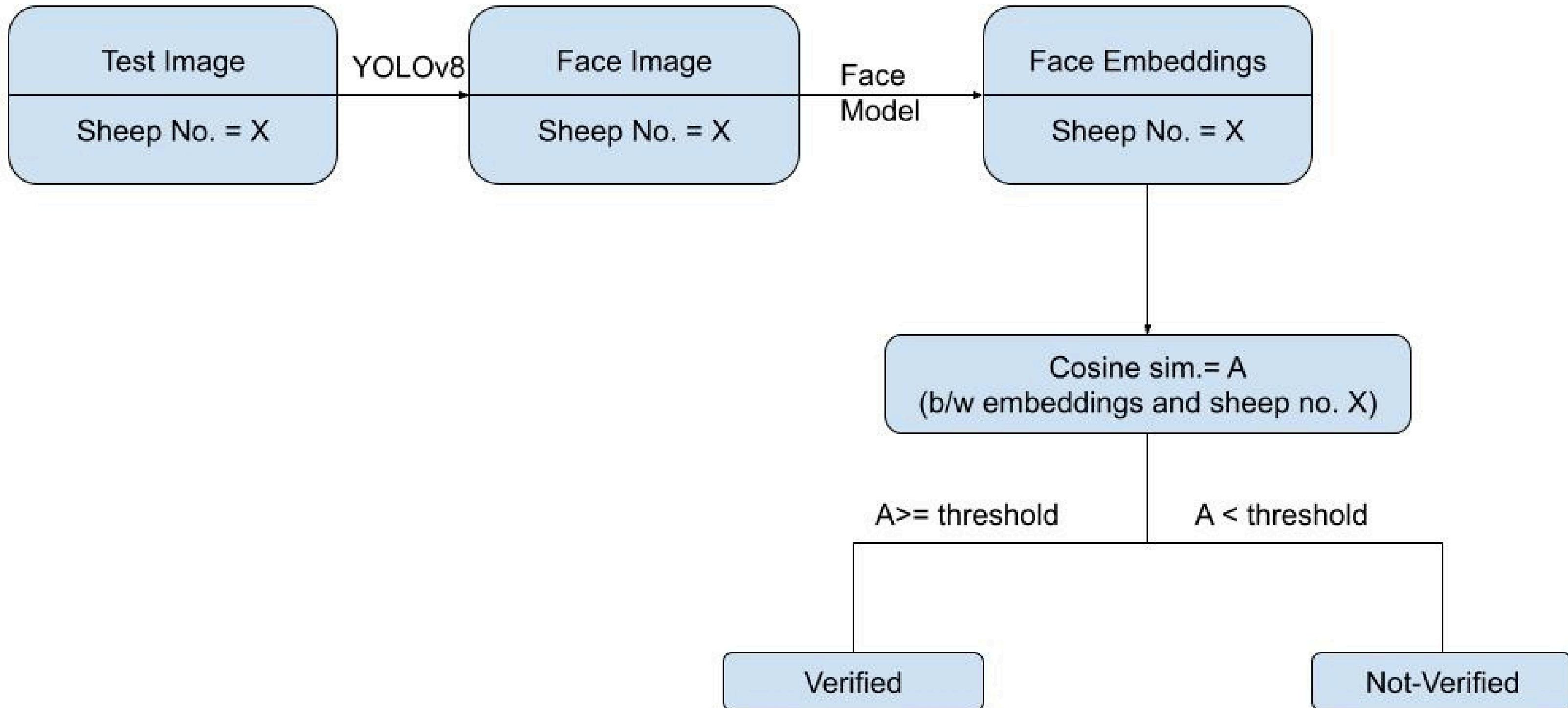




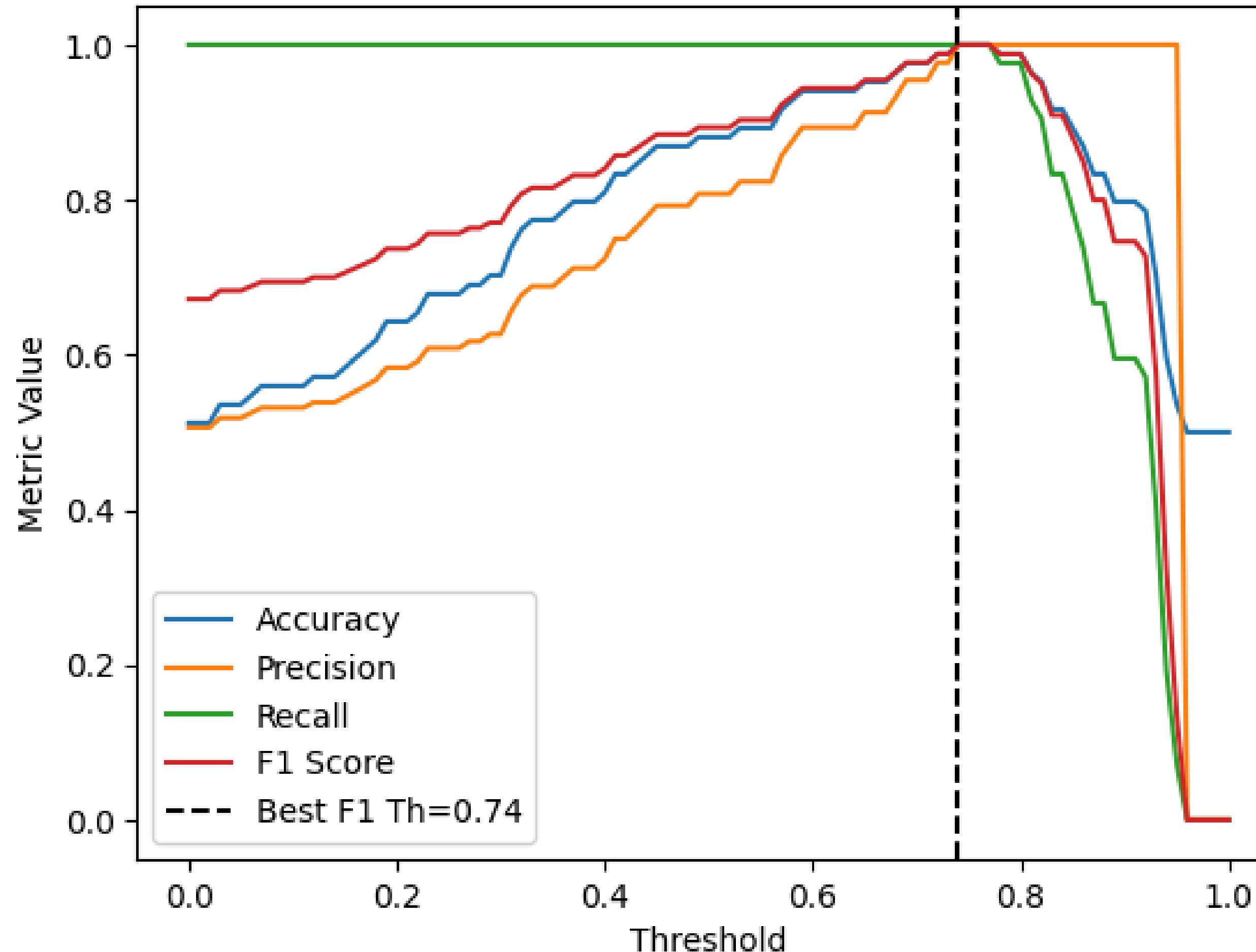
Verification & Threshold Tuning:

- Cosine Similarity Scoring
 - For each test embedding e_t , compute
 - $$\cos(e_t, g_i) = \frac{e_t \cdot g_i}{\|e_t\| \|g_i\|}$$
- Decision Rule
 - If cosine similarity $\geq \tau \rightarrow$ Accept as sheep i
 - Else \rightarrow Reject (impostor or unknown)
- Selecting τ
 - Sweep τ from 0.0 \rightarrow 1.0 in 0.01 steps
 - Plot Accuracy vs. τ to find optimal balance

Test and Evaluation

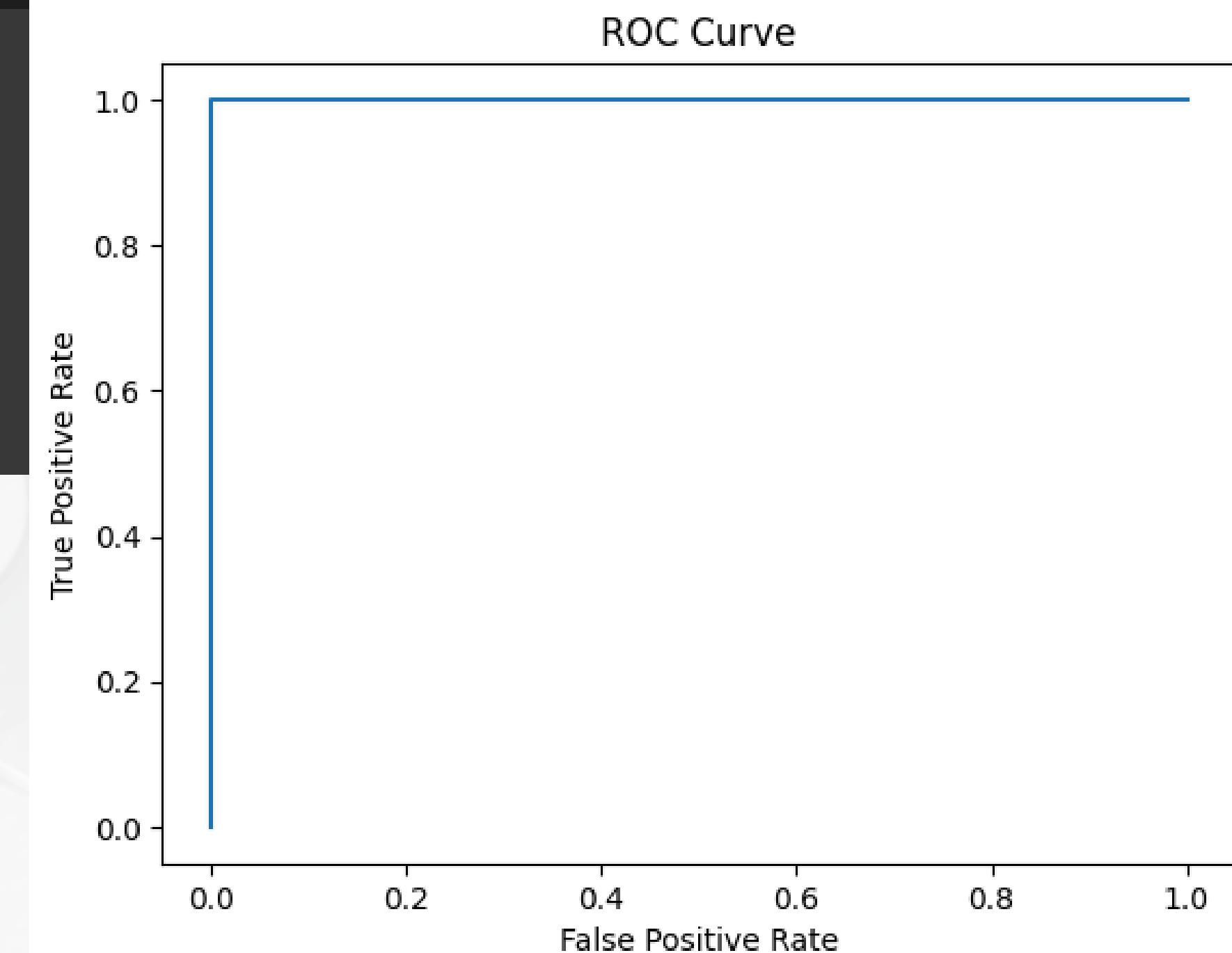


Threshold vs. Accuracy/Precision/Recall/F1



Test Results & Metrics:

Best Threshold: 0.74
Accuracy: 100.00%
Precision: 100.00%
Recall: 100.00%
F1 Score: 100.00%
AUROC: 1.000
AUPR: 1.000



Confusion Matrix

