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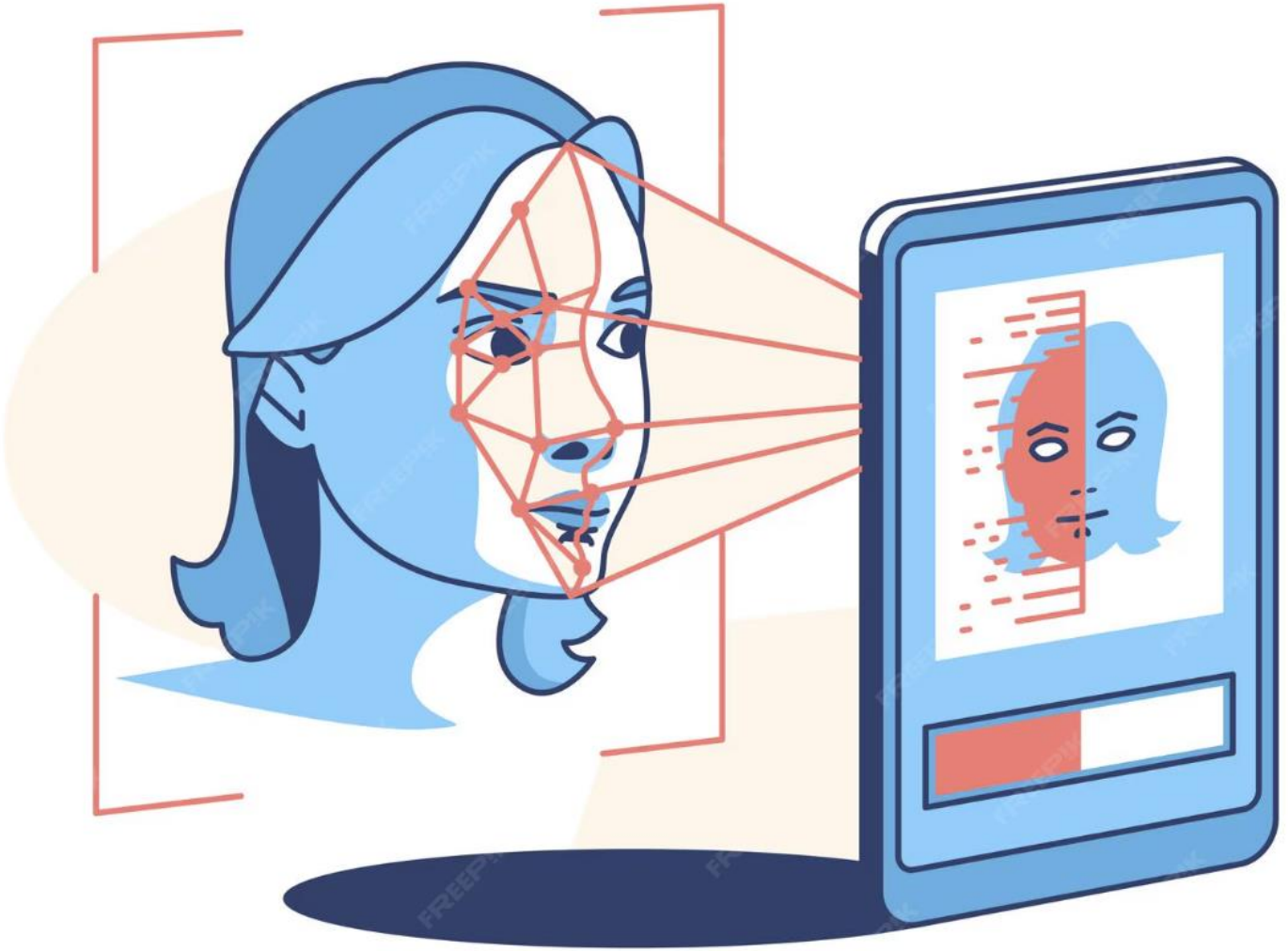
DEEP LEARNING FOR FACE RECOGNITION: RESEARCH & MINI-PROJECT SUMMARY

INTRODUCTION TO FACE RECOGNITION

1. Widely used in security, authentication, surveillance
2. Traditional methods struggled: lighting, pose, occlusion
3. Deep learning transformed the field

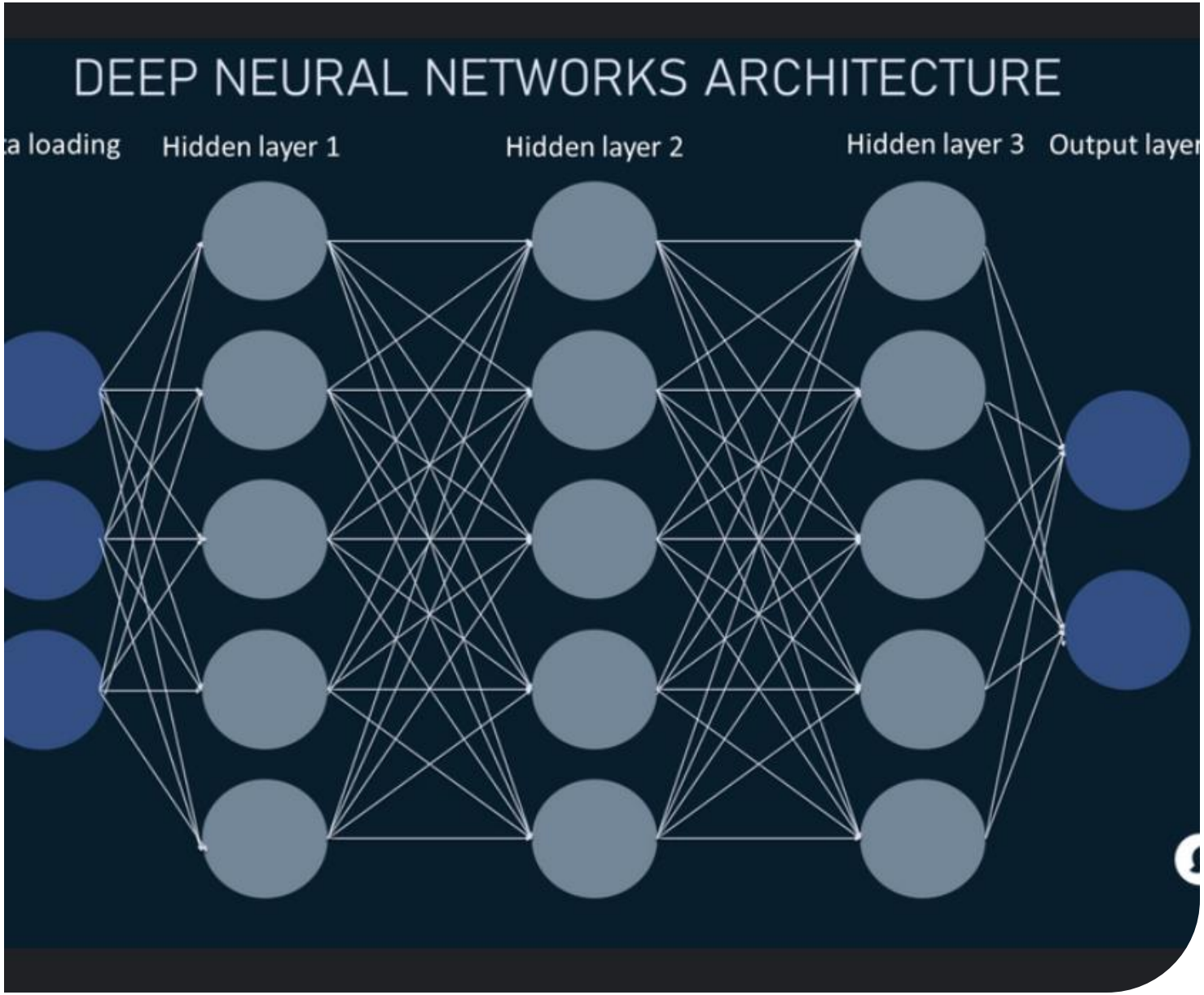
PROJECT MOTIVATION

- Mini-project complements research paper
- Build end-to-end face recognition pipeline
- Evaluate classification + verification approaches



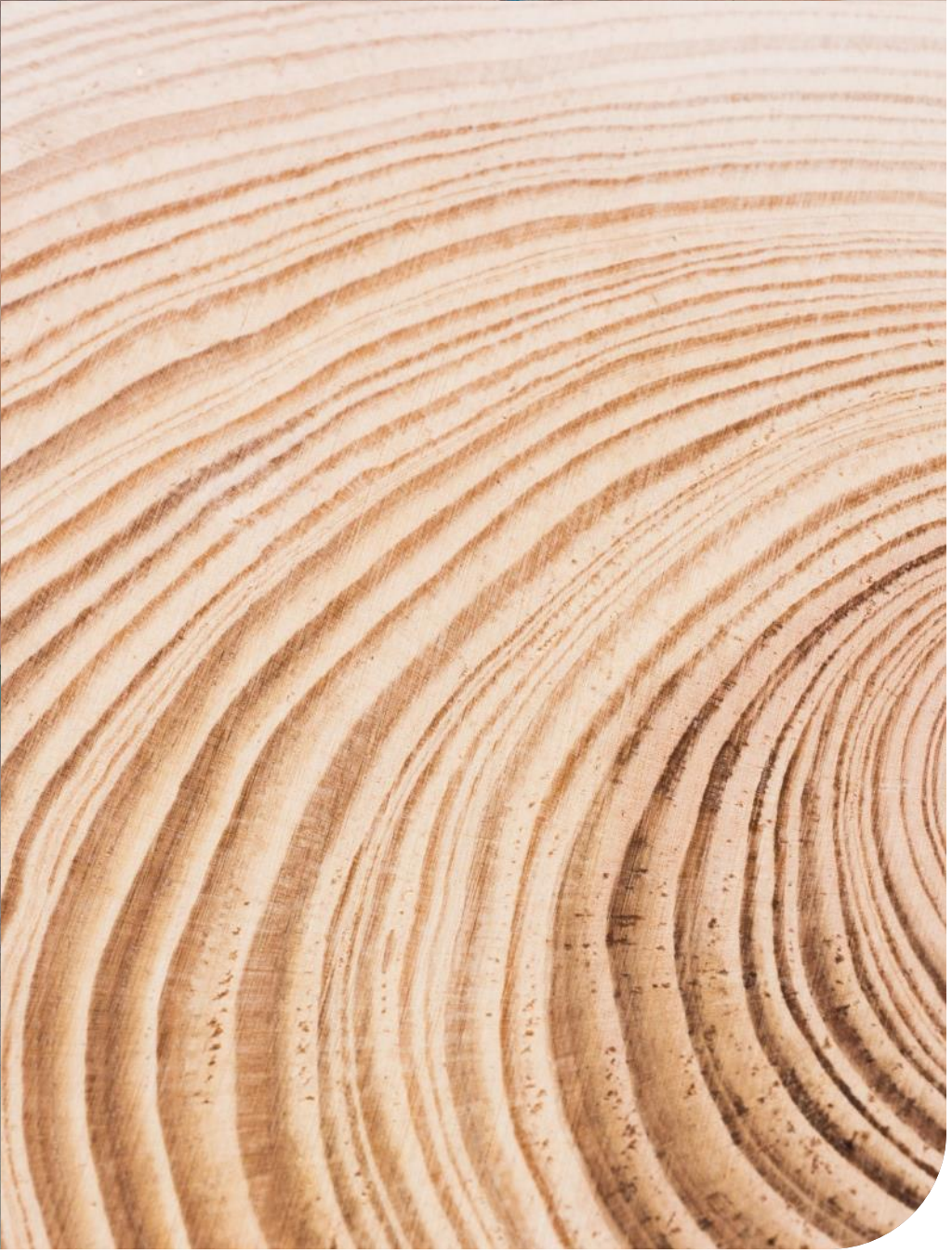
DATASET (LFW SUBSET)

- 3,000+ images, 62 identities
- Real-world variations: pose, illumination, occlusion
- Pre-processed to RGB, resized to 160×160



EMBEDDING EXTRACTION

- Used MobileNetV2 pretrained model
- Generates 1280-dimensional embeddings
- Basis for all further models



CLASSIFICATION MODELS

Logistic Regression

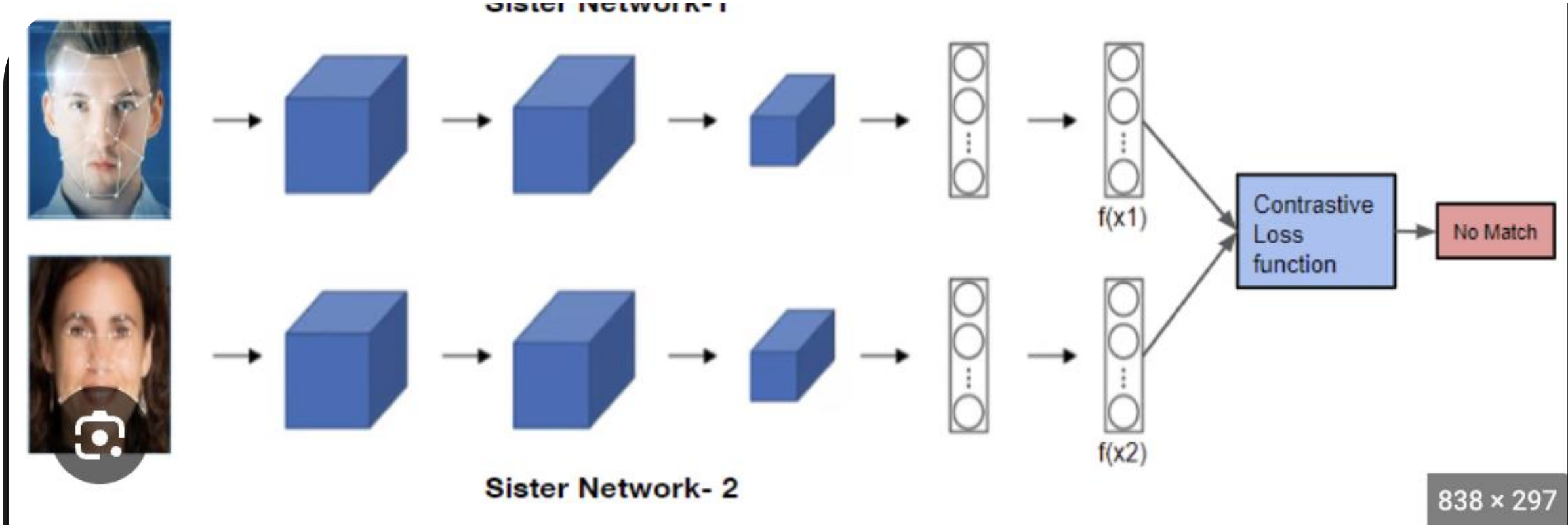
- Linear baseline

SVM (RBF)

- Non-linear separation
- Often performs better on deep embeddings

SIAMESE NETWORK FOR VERIFICATION

- Twin networks with shared weights
- Contrastive loss
- Determines if two faces belong to same identity



- LOGISTIC REGRESSION: **69.3%**
- SVM: **65.7%**
- SIAMESE NETWORK: **52.3%**

RESULTS SUMMARY

VISUALIZATIONS:

t-SNE
Shows partial clustering of identities
Overlap indicates limited separation

Confusion Matrix
• Correct predictions along diagonal
• Misclassifications due to class imbalance

KEY INSIGHTS

- K Deep embeddings useful even without CNN training
- Class imbalance affects accuracy
- Verification difficult without face-specific embeddings

LIMITATIONS AND FUTURE DIRECTIONS

- Embeddings not face-trained
- Siamese network trained on embeddings, not full images
- No adversarial or fairness evaluation

- Fairness and bias reduction
- Privacy-preserving methods (Federated Learning)
- Lightweight on-device models

Research Insights: Modern Advances

Content:

- FaceNet, ArcFace, Transformers
- GANs for augmentation
- Anti-spoofing and multimodal biometrics

CONCLUSION

- Built full pipeline: embeddings → classification → verification
- Results match real-world challenges
- Practical experience deepened understanding

THANK YOU

AML FINAL PROJECT PRESENTATION