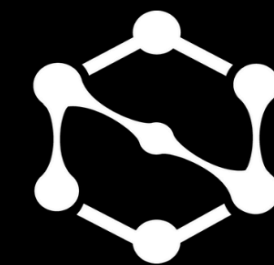


2nd EAAP Conference on Artificial Intelligence 4 Animal Science

Developed
by



NEOTEX



HALISI
Livestock

FacEDiM++

A Probabilistic Evaluation Framework for Few-Shot
Cross-Species Face Verification

By Deogratias LUKAMBA NSADISA, AI R&D Lead

Datasets and Benchmarks Theatre Session 06.



EAAP
European Federation
of Animal Science

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¹ NEOTEX BELGIUM, Artificial Intelligence Research Lab, Boulevard Lambert 129, B-1030 Brussels, Belgium,

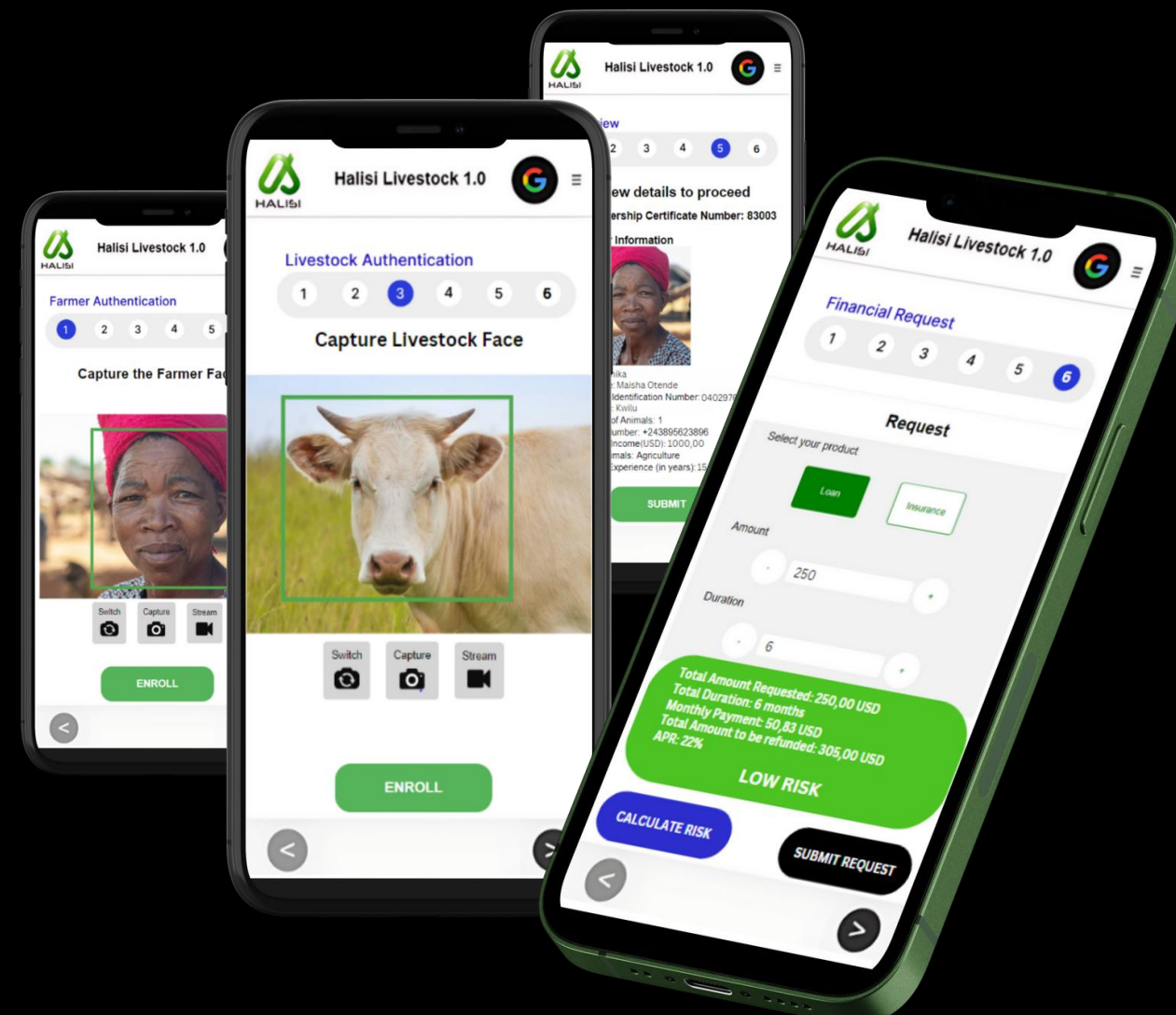
² NEOTEX RDC, Artificial Intelligence Research Lab, 5573, avenue Kauka, Q. Batetela, C. Gombe, CO-01204 Kinshasa,
Congo, Democratic Republic of the Congo

WHAT HALISI DOES

- ✓ Biometric e-KYC
- ✓ Biometric e-KYL
- ✓ Ownership Certificate
- ✓ Farmer Verification & Update
- ✓ Livestock Verification & Update
- ✓ Automated Credit Scoring
- ✓ Product Recommendation
- ✓ Loan & Insurance Request

Halisi equips financial institutions with **reliable data** for lending and insurance tailored to livestock farmers, empowering them to make **well-informed decisions!**

Inclusion



This proprietary technology is based on Artificial Intelligence and Privacy-Preserving Biometrics

Making Farmers Prosperous

A Solution based on **Artificial Intelligence and Biometrics** for Precision Farming and Financial Inclusion

Halisi utilizes **Artificial Intelligence and biometrics** to ensure exceptional reliability and traceability, establishing a new benchmark for data integrity.

Deployed in 9 Kenyan Localities

Kiambu, Gatundu, Kerugoya, Kiriaini, Wangige, Nyahururu, Limuru, Engineer, Thika



LIVESTOCK
Identification



LIVESTOCK
Valuation

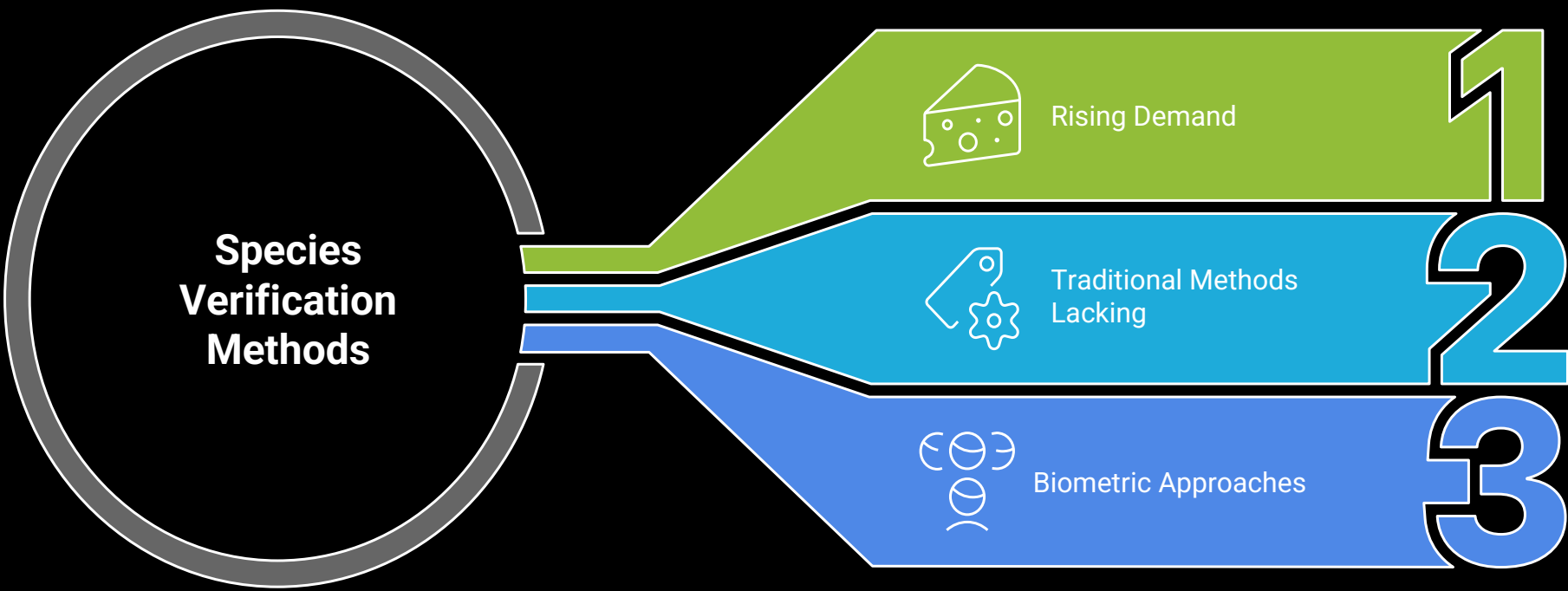


RISK
Mitigation

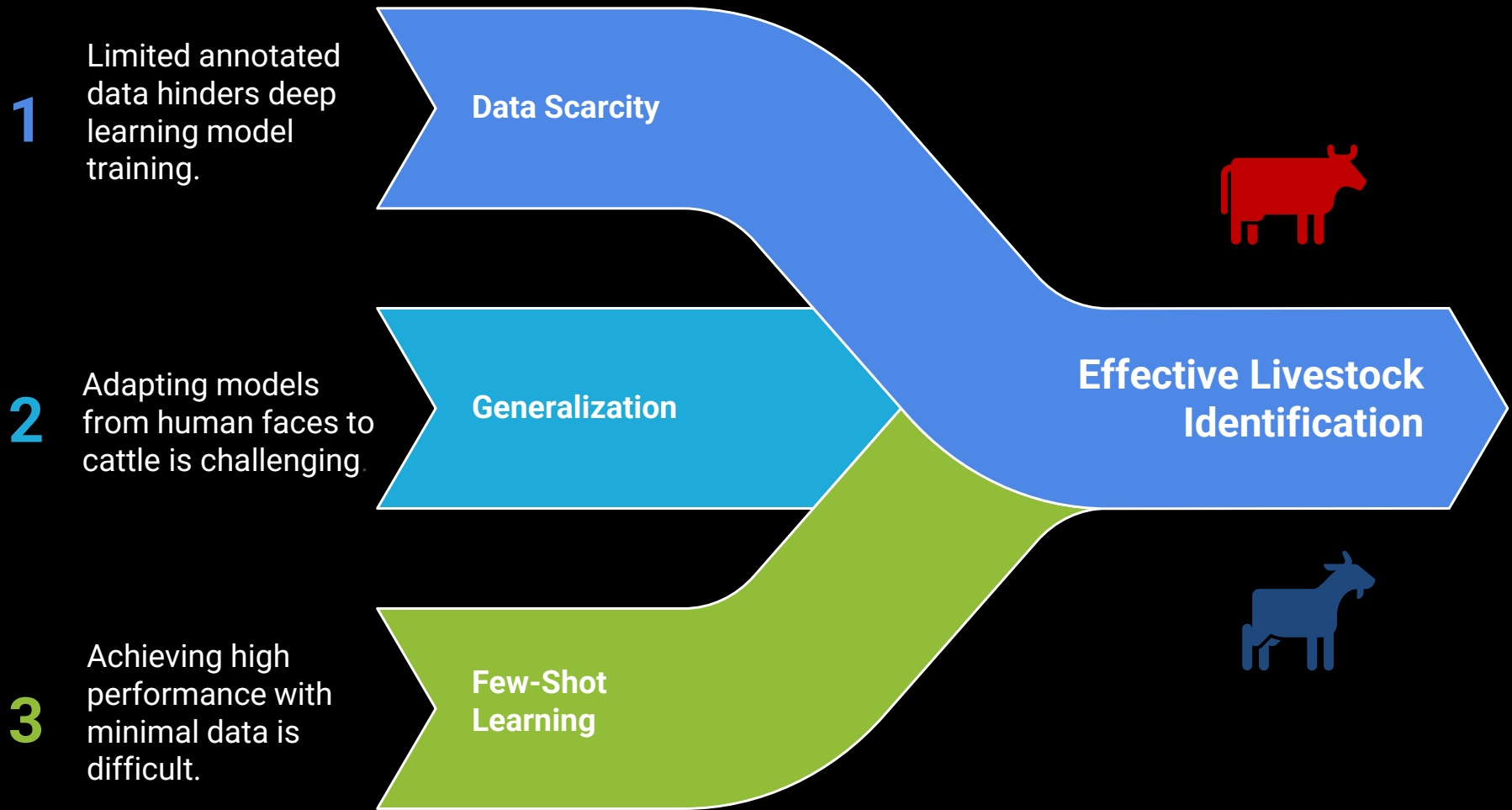


Importance & Challenges in Precision Livestock

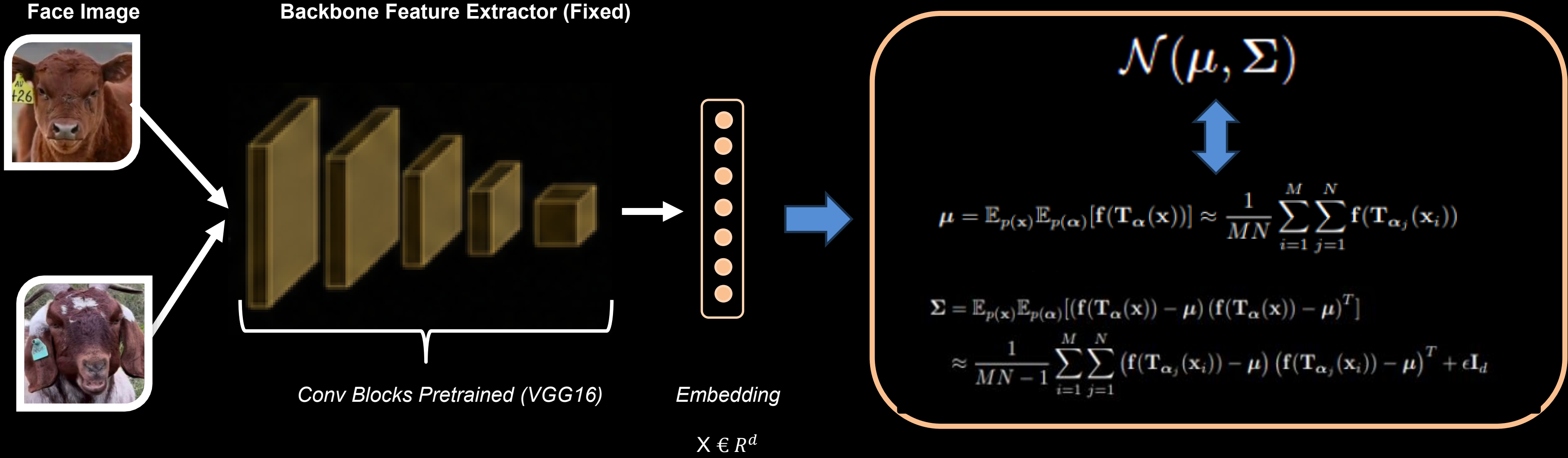
Exploring Livestock Authentication Methods



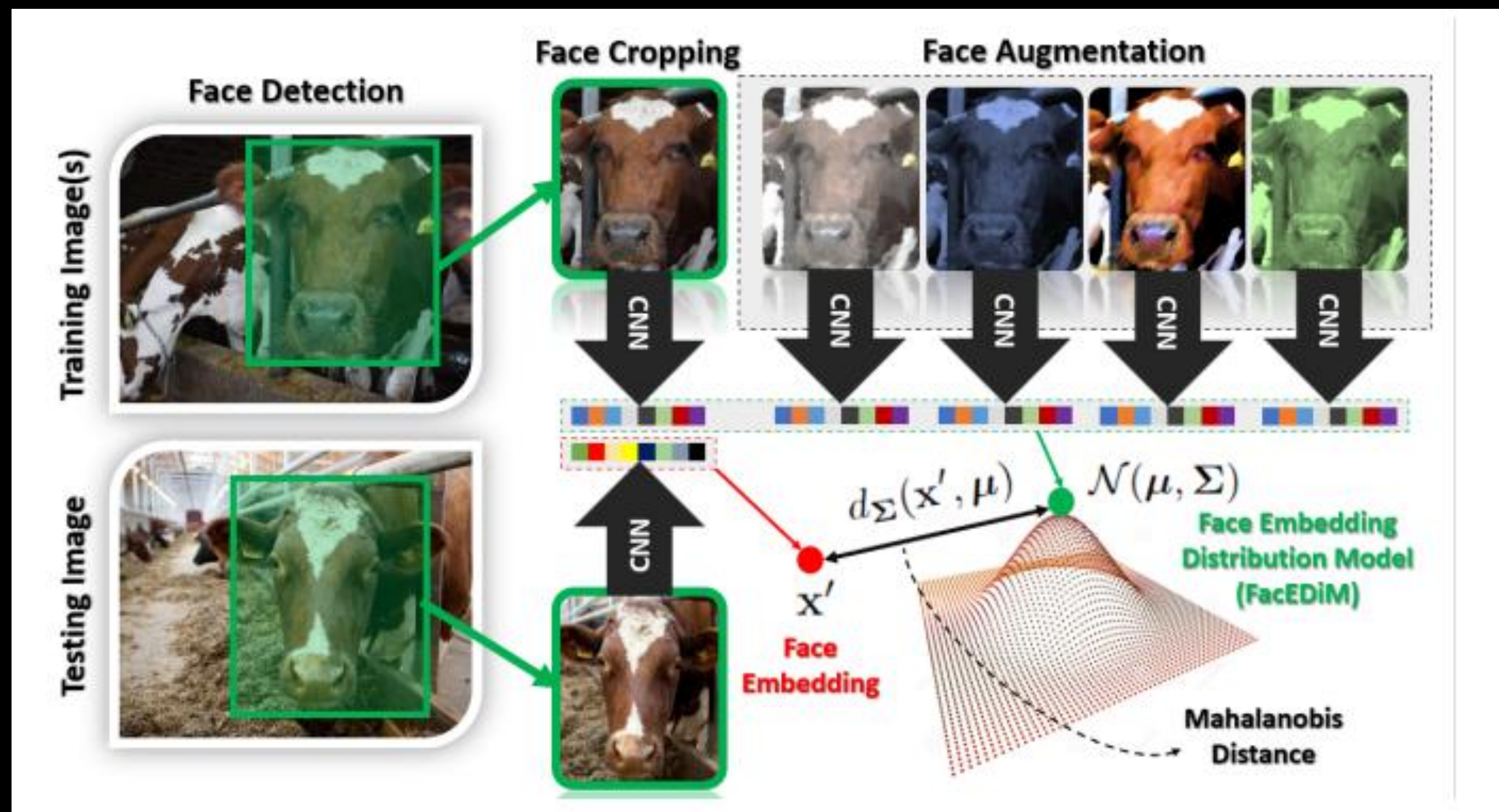
Overcoming Challenges in Livestock Authentication



Modeling Identity as Probability Distributions in Embedding Space



Information-Geometric Distance Measures for Robust Verification Reliability



Proposed Framework from Paper FacEDiM: A Face Embedding Distribution Model for Few-Shot Biometric Authentication of Cattle

Distance Measure for Robust Verification Reliability

$$d_{\Sigma}(x', \mu) = \sqrt{(f(x') - \mu) \Sigma^{-1} (f(x') - \mu)^T}$$



Biometric authentication = anomaly detection in embedding space

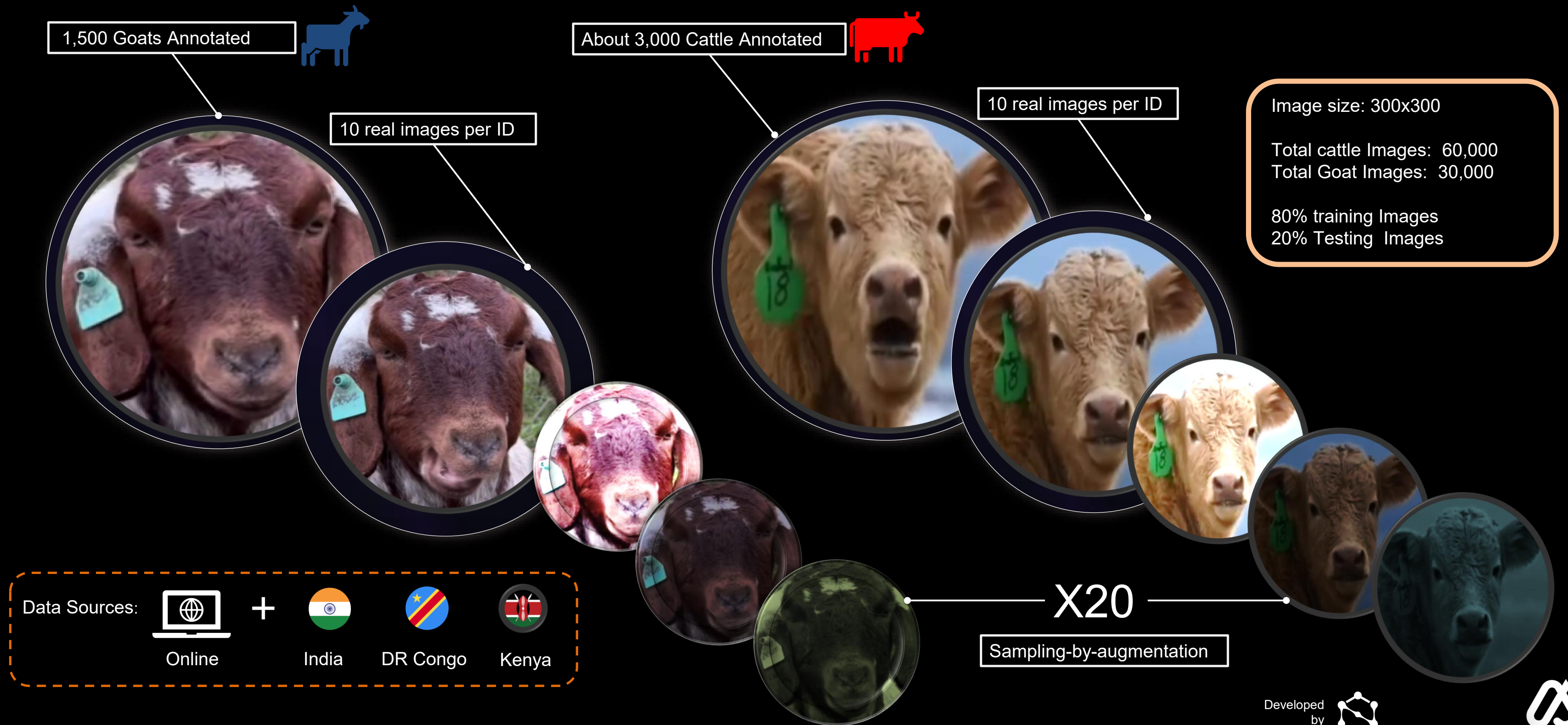


Model each identity as a distribution of embeddings

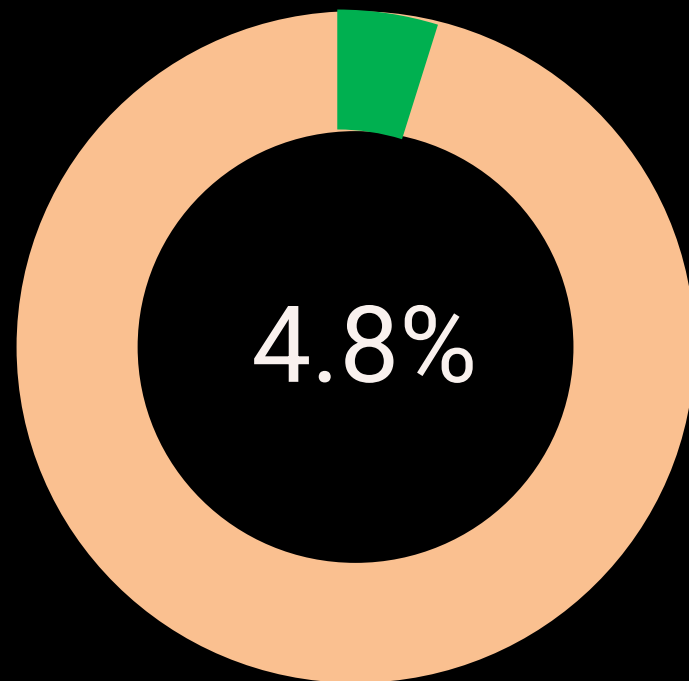
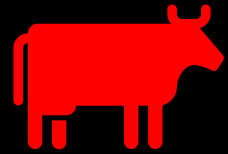


Verify livestock face using Mahalanobis distance from learned distribution

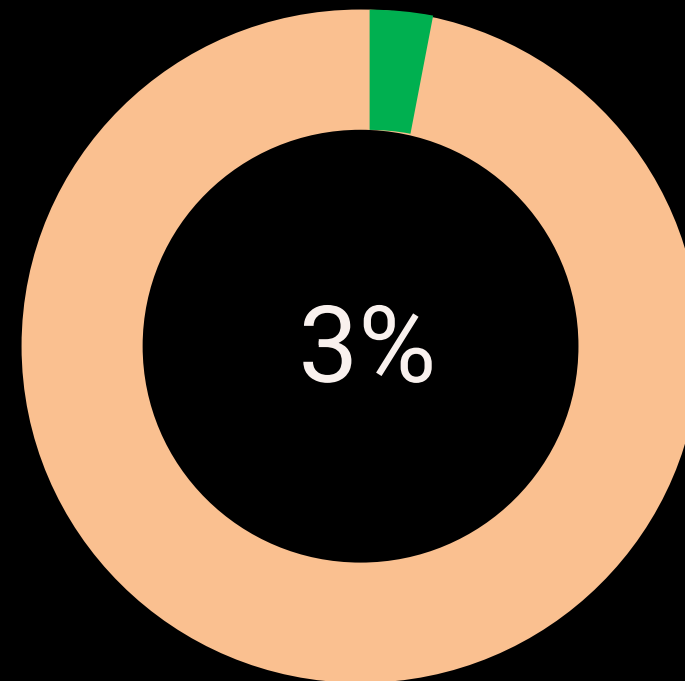
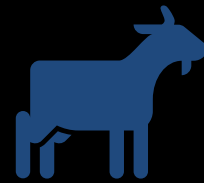
Dataset Overview & Experimental Protocol



Evaluation & Reliability Analysis



Cattle False Rejection Rate
@FAR=1%



Goats False Rejection Rate
@FAR=1%

Cattle: strong separation between genuine and impostor distributions.

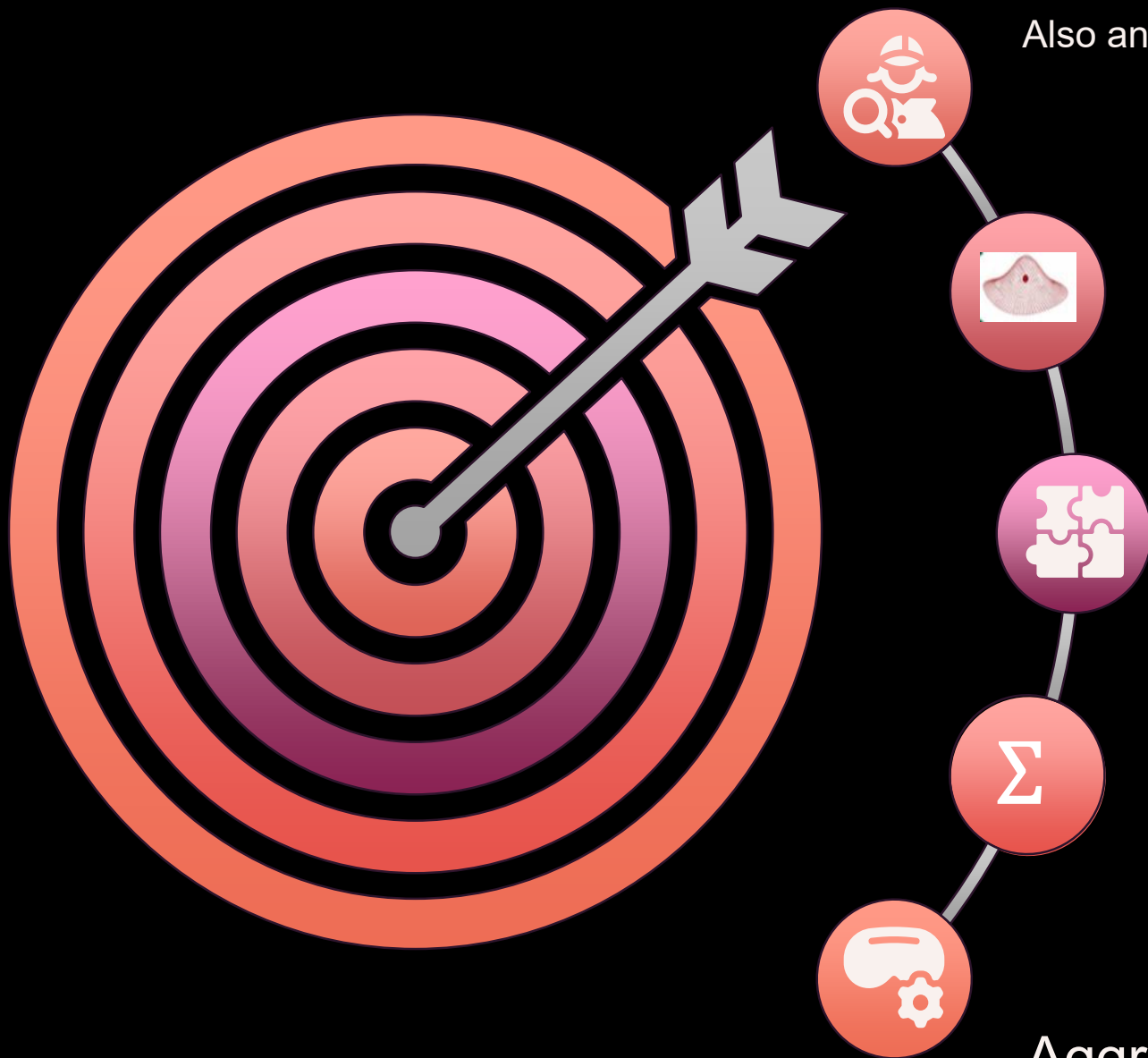
Goats: similarly reliable verification despite fewer and more variable captures.

Interpretation: reliable verification even with scarce data and heterogeneous conditions.

Discussion, Limitation & Conclusion

Probabilistic Biometric Verification Framework

Also an evaluation layer built on top of a deep embedding model



Distribution-Based Scoring

Helps quantify uncertainty in embedding space
Framework useful when number of real shots is very small

Embedding Quality

Affects overall performance

Covariance Estimation

Can be unstable with limited data variations

Aggressive Augmentation Strategy

May impact distribution reliability

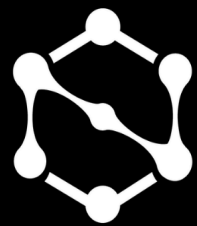


Extending to Additional Species





Developed
by



NEOTEX

Join us as we turn
individual animal data
**into precision
livestock farming**



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Q&A

