Face Recognition

LATTICE SEMICONDUCTOR®

MODEL DETAILS

This model is designed to generate face embedding vectors from input images. By computing the cosine similarity between two embeddings, it determines whether the faces belong to the same individual.
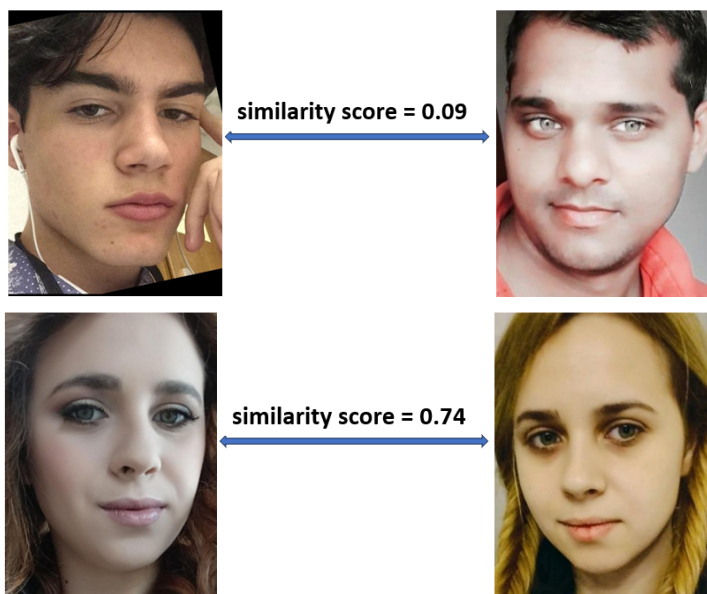

Figure 1: Cosine similarity computed between 128-dimensional embedding vectors derived from the model outputs for each pair of cropped face images.

MODEL SPECIFICATIONS

Inputs

- 96×96×1 grayscale image

Outputs

- 128-dimensional embedding vector representing the input face image.

Architecture

- MobileFaceNet-like model

Parameters

- 940,312 (922,216 trainable, 18,096 non-trainable)

AUTHORS	Lattice Semiconductor	**SOURCE CODE**	Training Source Code
VERSION	fr-fpga-8.1.1	**TOOLCHAIN**	LATTE
RELEASE	2025-12-18		LSCQuant

PERFORMANCE EVALUATION

Live Evaluation

Evaluations were performed on Lattice CLNX-33 FPGA and IMX219 camera, under a controlled, standardized environment to ensure consistency and reproducibility of results. While these conditions shaped the reported metrics, the model architecture is designed for flexibility, supporting potential deployment across a wide range of platforms, including non-FPGA environments.

- User Positioning: For both enrollment and identification, users must face the camera with a neutral pitch and roll. Yaw should remain within ±15 degree and the face must be fully visible in the frame.

- The system was evaluated at distances ranging from 40 cm to 2 m. When a user is enrolled at the optimal depth (~60 cm), both detection and identification remain accurate and consistent across varying lighting conditions, including dark, dim (20–30 lux), bright, and ideal environments within the 30 cm to 2 m range.

Offline Evaluation

The KPIs for the evaluation data are reported in Table 1, for Chicago and LFW (594 IDs) datasets. Categorical metadata for quantitative analysis were generated using Gender Classifier, Age Classifier, and Deep Face. Figure 2 illustrates the false positive rate by age, ethnicity and gender categories.

Table 1: Face Recognition Accuracy and False Positive Rate (FPR) with Similarity Threshold = 0.55.

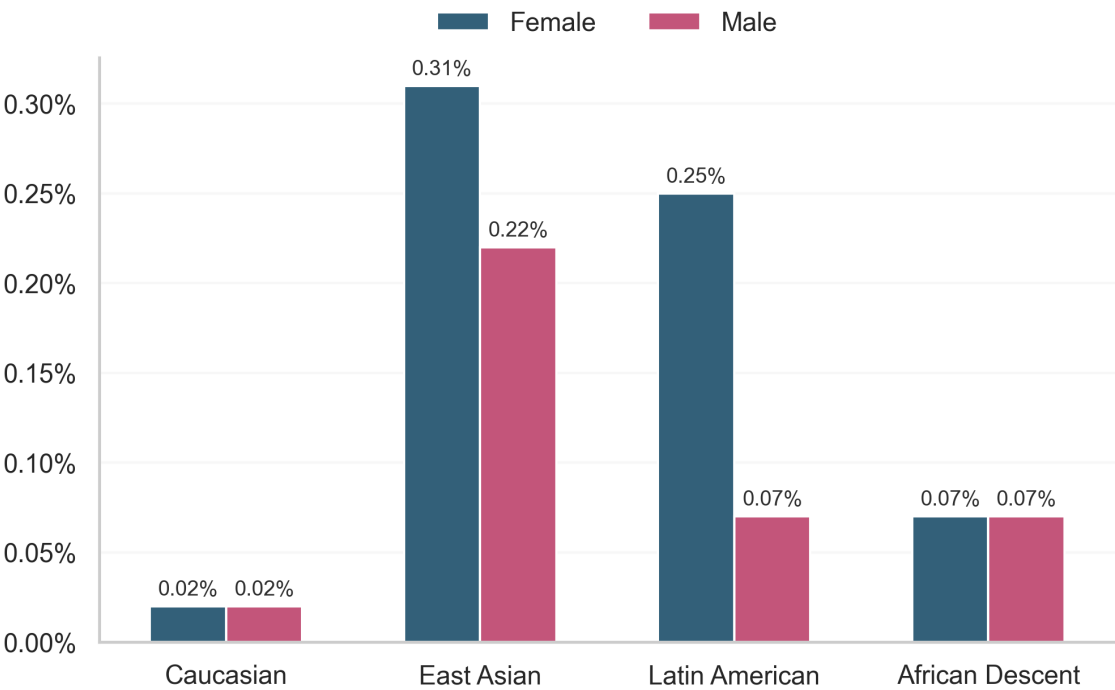| Dataset	Metric Name	Value	Comments
LFW	Accuracy	97.55%	6000 positive and negative pairs
Chicago	FPR (East Asian)	0.15%	109 IDs
Chicago	FPR (African Descent)	0.03%	194 IDs
Chicago	FPR (Caucasian)	0.01%	183 IDs
Chicago	FPR (Latin American)	0.08%	108 IDs

Figure 2: Comparison of False Positive Rates across demographic groups (Chicago dataset).