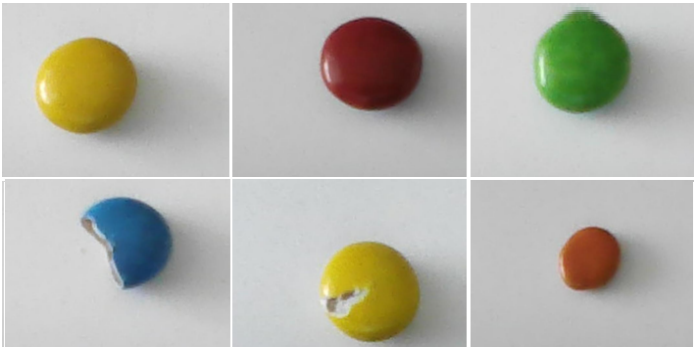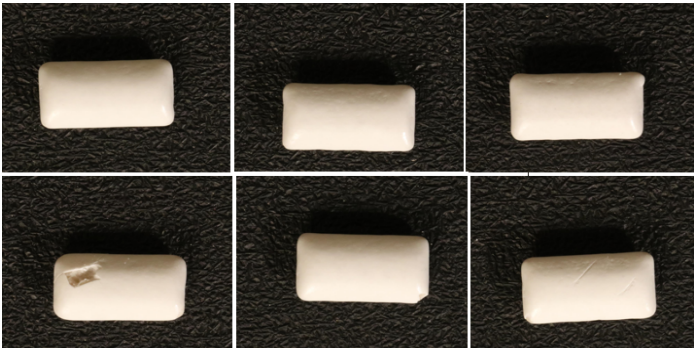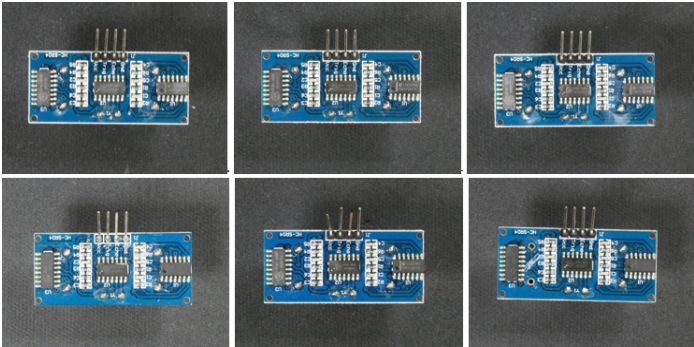# Few-shot Defect Detection

MODEL DETAILS

This model implements binary few-shot defect detection using a Siamese network architecture.

(a)

(b)

(c)

Figure 1: Defect complexity: (a) Low, (b) Medium, and (c) High, with normal (top) and anomalies (bottom) samples.

MODEL SPECIFICATIONS

Inputs

- 384×288×3 RGB image

Outputs

- Score of the detection

Architecture

- Backbone: MobileNetV2-inspired model
- Head: Siamese model

Parameters

- 1,085,364 parameters

AUTHORS	Lattice Semiconductor	
VERSION	dd-cpnx-8.1.2	
RELEASE	2025-12-18	

SOURCE CODE	Training Source Code
TOOLCHAIN	LATTE
	LSCQuant

PERFORMANCE EVALUATION

Live Evaluation

The evaluation of the few-shot learning process was performed on two sets of images collected under a controlled, standardized environment to ensure consistency and reproducibility of results. Images were collected with a Logitech Brio and IMX219 cameras. The few-shot learned models achieved 100% and 98% accuracy, respectively.

- Hardware Platform: Lattice CPNX-100.
- Camera System: The same camera used to capture the dataset should also be used during deployment.
- The background should be a solid, uniform color that provides high contrast with the target object.
- Illumination should be consistent and maintained under the same conditions for all samples.

Offline Evaluation

To validate the few-shot learning process, a public dataset (VisA) and an in-house dataset were used. The KPIs for the evaluation data are reported in Table 1. The datasets have the following defect types:

- Lattice - Smarties: data includes broken, chipped edge, burned edge, deformed shapes.
- VisA - Chewing gum: minor edge chip, fine scratch, partially broken.
- VisA - pcb2: minor abrasion, fractured, minor burn, warped component.

Table 1: Model performance across datasets.

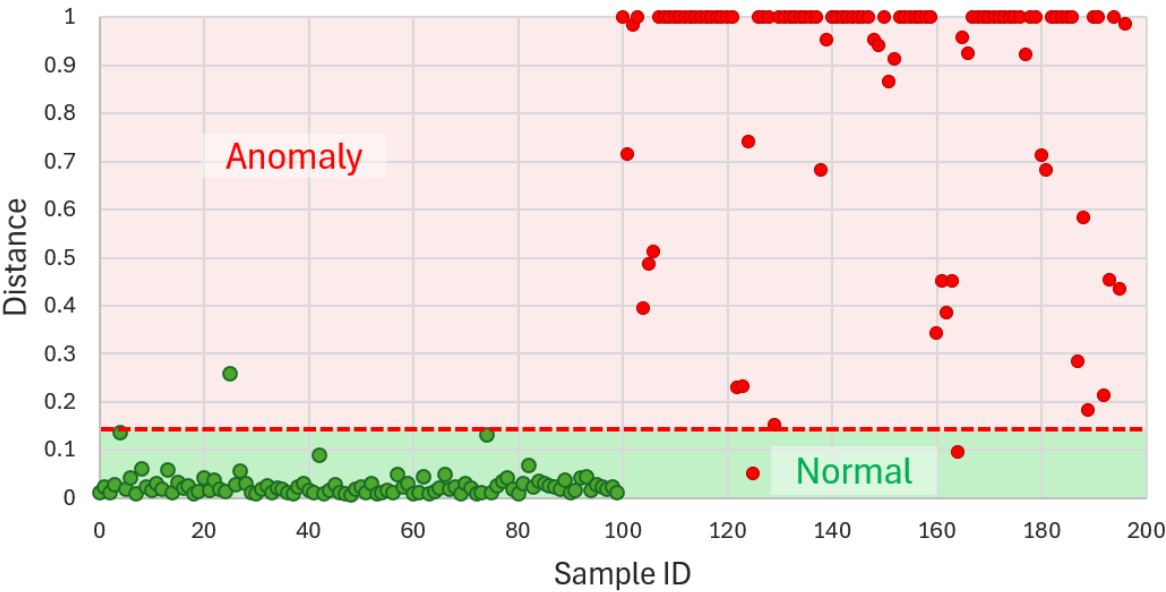| Dataset	Defect Complexity	Training Shots	Test — Normal	Test — Anomaly	Anomaly ACC	Normal ACC	AU-PR	F1 Score
Lattice — Smarties	Low	30	100	100	99%	98%	0.999	0.985
VisA — Chewing gum	Medium	20	100	50	90%	95%	0.952	0.900
VisA — pcb2	High	30	70	70	84%	83%	0.899	0.870

Figure 2: Distance estimates between smarties samples and the reference vector representing the normal class.