ClearLens

Cutting-Edge Camera Tampering and Anomaly Detection System for Video Surveillance
système de pointe permettant de détecter les anomalies et le sabotage des caméras de vidéosurveillance

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Problems:
- Surveillance cameras can give low-quality images due to ageing, intruder attack, physical disturbances on lenses, etc.
- Smart systems using these low-quality images may make wrong decisions/lead to serious consequences

Objectives:
- Develop an AI-based system that monitors surveillance camera images in real-time
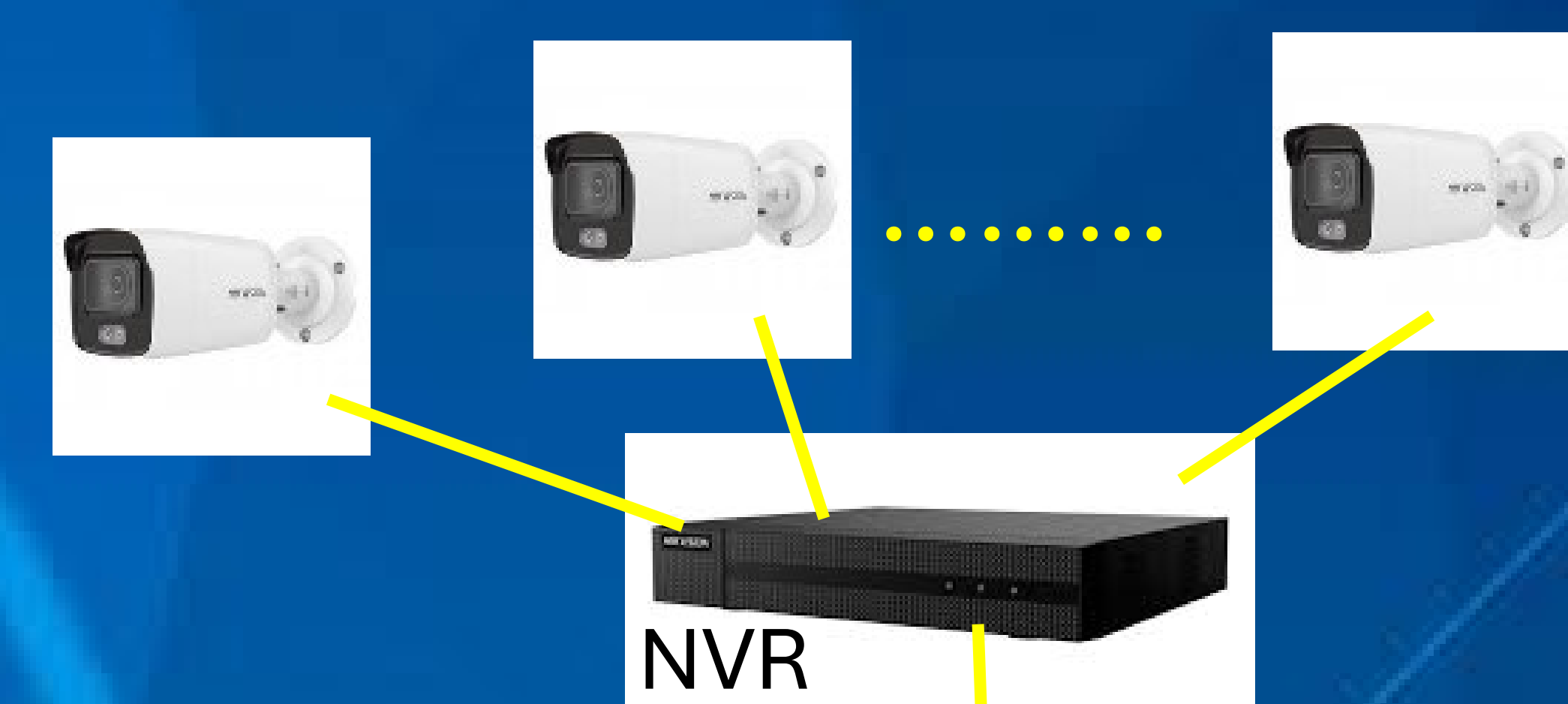- Evaluate the quality of the image by detecting the anomalies haze, defocus, dirt, & spray paint blur

Difficulty: Highly imbalanced training data
Imbalance in quantity
- Surveillance image with defects are difficult to find

Imbalance in data distribution
- Some image classes are similar while some are significantly different (overfitting in training)

Normal, Haze, Defocus, Dirt, Spray Paint

NVR — Embedded Device

Cam 1: Normal
Cam 2: Dirt
Cam 3: Normal
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Methods:
Data level:
- Develop two new dirt and spray paint blur image synthesizers to generate anomalous surveillance images to balance the training dataset

Algorithm level:
- Develop a self-supervised attention-based deep residual model to tackle the imbalanced data distribution problem
- Design a small bottleneck ResNet structure to simplify the model for embedded devices implementation

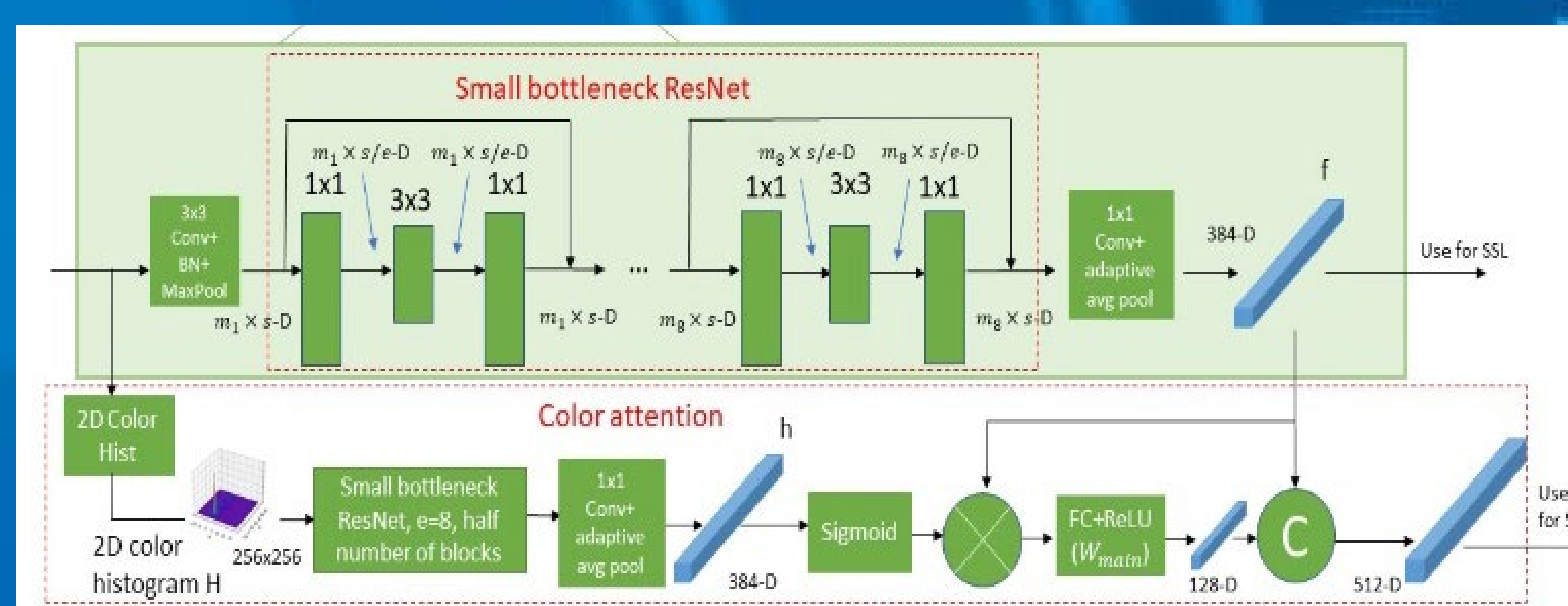### Proposed Deep Learning AI Model

Results:
Develop an **image dataset of 15,000 images**
- 4 anomalous image classes with same number of image for training
- Synthesized images closely resemble the real ones

Develop a **low-cost (<US$150)** surveillance camera monitoring system
- Real-time scanning a **30-camera surveillance system in about 30 sec** in background without affecting the normal operation
- Achieve an accuracy of **over 90%** on detecting 4 common anomalies

Patent:
1. Title: System and Method for Spray Paint Image Synthesis in Surveillance Camera Anomaly Detection.
Registered region and date: Hong Kong, 02/12/22
Patent No: HK30076502
2. Title: System and Method for Surveillance Camera Anomaly Detection.
Registered region and date: PRC
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