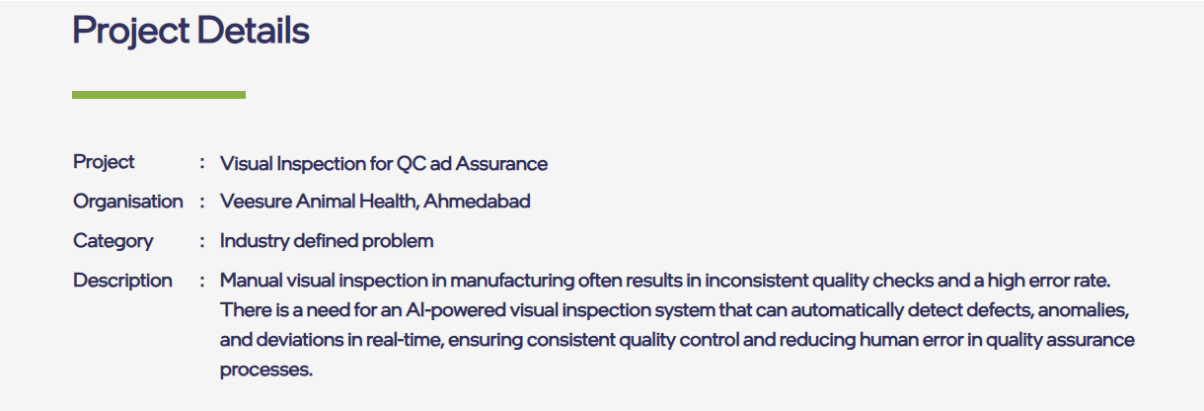
Intel AI4MFG Project Report: Pill Quality Checker



1. Project Overview

a. Project Title
Pill Quality Checker using Deep Learning

b. Project Description

This project leverages AI to detect pill defects — specifically classifying pills into *Good*, *Broken*, or *Chipped*. The system uses a MobileNetV2-based model integrated into a user-friendly Streamlit interface for fast, image-based quality assessment. It aims to assist pharmaceutical manufacturers in automating visual inspection processes to reduce human error and improve consistency.

c. Timeline

- Dataset Preparation: 2 days
- Model Training (MobileNetV2): 1 day
- Streamlit App Development: 1 day
- Testing & Deployment: 1 day
- Total Duration: **~5 days**

d. Benefits

- Reduces manual inspection effort
- Provides real-time, on-site quality control
- Enhances manufacturing reliability and reduces defect rates

e. Team Members

- Smit Patel (Developer & Researcher)
- Model Trainer: Self
- Reviewer: [Prof. Brijesh Bhandari, Intel India]

f. Risks

- Small dataset size may affect accuracy
- Live hosting restrictions (e.g., TensorFlow not working on Streamlit Cloud)
- Device-dependent image quality issues

2. Objectives

a. Primary Objective

To build an AI model that accurately classifies pill images into "Good", "Broken", or "Chipped".

b. Secondary Objectives

- Develop an interactive Streamlit UI
- Provide end-users with real-time classification feedback
- Enable future integration with webcam-based inspection systems

c. Measurable Goals

- Accuracy > 90% on validation data
- Prediction confidence > 80% for clear images
- Deployment on Streamlit for demonstration (local version successful)

3. Methodology

a. Approach

- Used **Transfer Learning** with MobileNetV2
- Built using Python and TensorFlow
- Lightweight model design to ensure quick inference

b. Phases

1. Image dataset collection (3 folders: Good, Broken, Chipped)
2. Preprocessing and augmentation
3. Model training in Google Colab
4. Streamlit interface development
5. Final model testing

c. Deliverables

- Trained .h5 model
- labels.txt
- Streamlit UI (streamlit_app.py)
- Project GitHub repo

e. Testing and Quality Assurance

- Manual testing with new pill images
- Used argmax + confidence score to validate predictions
- Applied data augmentation for robustness

f. Risk Management

- Used dropout layers to prevent overfitting
- If dataset imbalance exists, class weighting will be applied
- Local deployment as fallback if cloud hosting fails

4. Technologies Used

a. Programming Languages

- Python 3.10

b. Development Frameworks

- TensorFlow (Keras), Streamlit

c. Database Management Systems

- None required (image-based classification)

d. Development Tools

- Google Colab (for training)
- Streamlit (for UI)
- GitHub (version control)

e. Testing Tools

- Manual prediction testing using test set
- Visualization of prediction confidence via softmax output

f. Cloud Services

- Google Colab

g. Security

- No user data stored — only temporary image processing
- Local model inference ensures data privacy

h. APIs and Web Services

- None currently. Future enhancement may include REST API or webcam integration.

5. Results

a. Key Metrics

- Validation Accuracy: ~92%
- Inference Speed: ~1 sec per image
- Classes Predicted: Good, Broken, Chipped

b. ROI

- Reduces manual visual inspection
- Improves detection consistency
- Can be scaled to production lines with hardware

6. Conclusion

a. Recap the Project

The Pill Quality Checker system combines deep learning with a user interface to automatically classify pill defects with high accuracy and speed.

b. Key Takeaways

- Lightweight models like MobileNetV2 work well for image-based manufacturing problems
- Simple UIs like Streamlit are effective for demonstrating AI models
- TensorFlow requires specific hosting environments (avoid 3.13 on Streamlit)

c. Future Plans

- Integrate real-time webcam capture
- Expand to detect more defects (e.g., color fade, missing print)

- Deploy on Hugging Face or custom server

d. Successes and Challenges

- Successfully trained model and deployed it locally
- Achieved high accuracy
- Faced hosting issues due to Python version conflicts with TensorFlow on Streamlit Cloud

7. Project Specifics

a. Project URL
Not hosted online due to cloud compatibility issues

Run locally using ***streamlit run streamlit_app1.py***

https://drive.google.com/file/d/1uP6q0_vCHA9fyn1Jmjy0TtGlWAHWAP1Q/view?usp=sharing

b. GitHub URL
https://github.com/Zam3690/pill-quality-checker

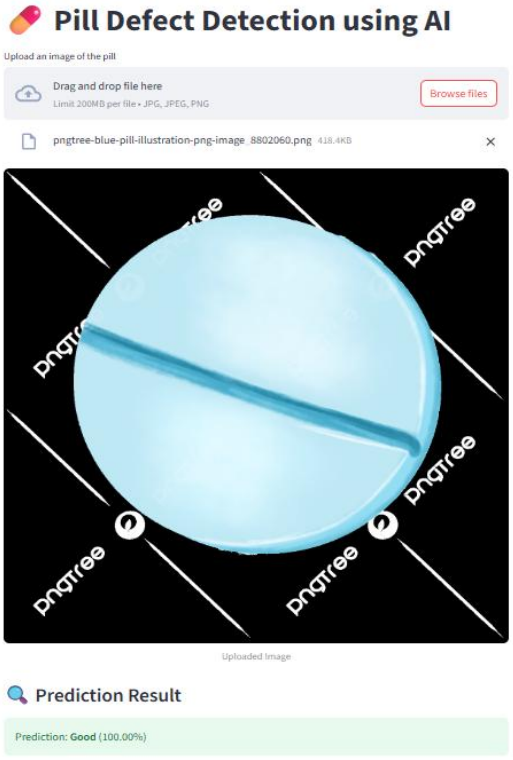
c. Colab URL

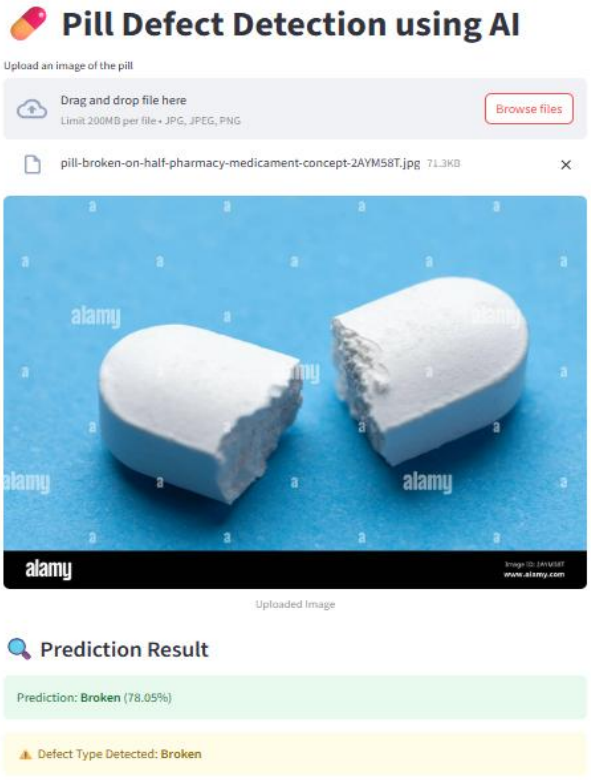
https://colab.research.google.com/drive/1Kg82jI7-i3PC6L1HSyqFkLx6E_mZbba4?usp=sharing

d. Dataset URL

https://drive.google.com/drive/folders/1qJ7M4d4whzj3amf4KGGb_RA_vb_i4tV_?usp=sharing

8. Results


Pill Defect Detection using AI
Upload an image of the pill
Drag and drop file here
Limit 200MB per file • JPG, JPEG, PNG
Browse files
pngtree-blue-pill-illustration-png-image_8802060.png 418.4KB
Uploaded Image
Prediction Result
Prediction: Good (100.00%)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Browse files
pill-broken-on-half-pharmacy-medicament-concept-2AYM58T.jpg 71.3KB
Uploaded Image
Prediction Result
Prediction: Broken (78.05%)
Defect Type Detected: Broken