



Coin Analysis And Classification

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Coin Detection Pipeline

Watershed segmentation

- Convert image to **grayscale** and apply **Gaussian blur**
- Apply **Otsu's thresholding** to separate coins from background
- Use **morphological opening** to remove small noise
- **Dilate** the image to get 'sure background' regions
- Apply **distance transform** to find 'sure foreground' (coin centers)
- Label regions and create **markers**
- Run **Watershed algorithm** to segment overlapping coins
- Extract and **crop individual coins** from the original image
- Save coin crops for further **classification or analysis**



Estimating UK Coin Value Per Image

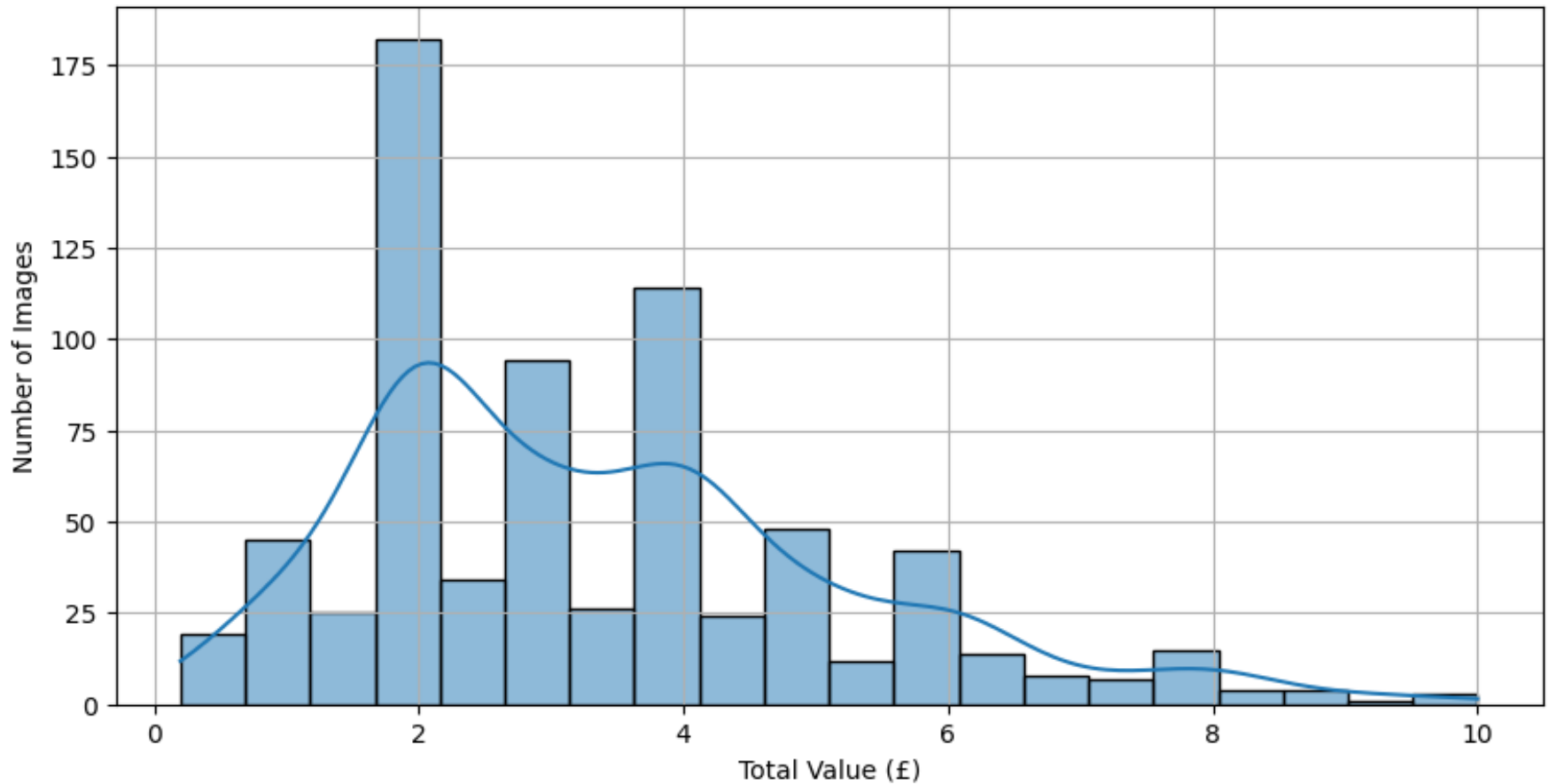
Heuristic Approach

- Applied a **rule-based classifier** to estimate coin type
- Converted each coin to **HSV color space**
- Used **average hue** and **coin size** (diameter) to classify:
- Silver + small → likely **5p, 10p**
- Reddish + small → likely **1p, 2p**
- Mapped each coin to its **monetary value**
- **Summed values** by original image to estimate total value
- Plotted a **histogram** showing value distribution across images
- Quick, interpretable results **without training a model**



Visualization

Distribution of Total Coin Value per Image



CNN Model for Heads/Tails Classification

Transfer Learning

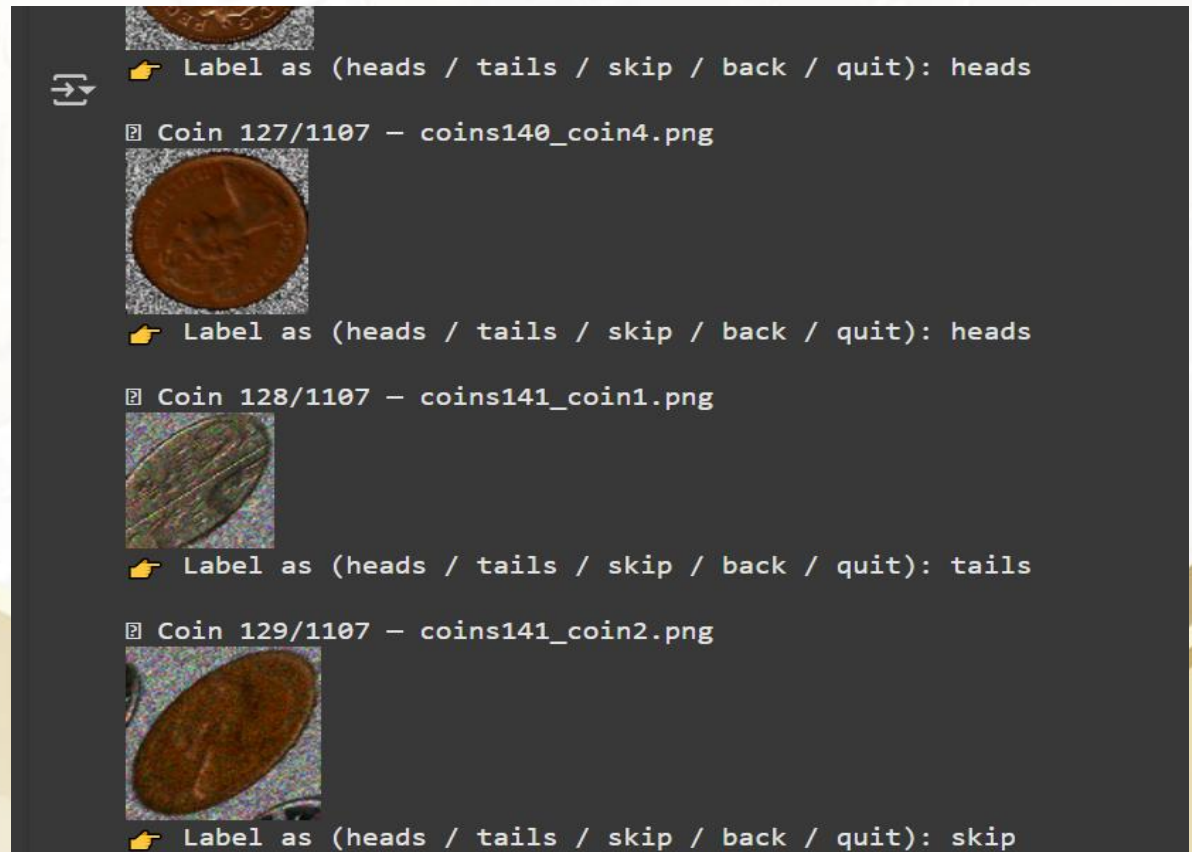
- Used **MobileNetV2** as a pretrained base model (ImageNet)
- Removed original output layers and added a **custom binary classifier**
- Architecture:
- Global Average Pooling → Dense Layer → Dropout → Sigmoid output
- **Base model frozen** (trainable=False) to avoid overfitting
- Trained on a **small labeled dataset** of cropped coin images
- Efficient, accurate setup for quick training on limited data
- Can optionally be **fine-tuned later** for higher performance





Manual Labeling Tool (For Training Data)

- Built a **simple interactive loop** to label cropped coin images
- Labeled up to **150 coins manually** as "heads" or "tails"
- Used **keyboard input** to assign labels (heads, tails, skip, back, quit)
- Saved all results in a clean **CSV file** for training



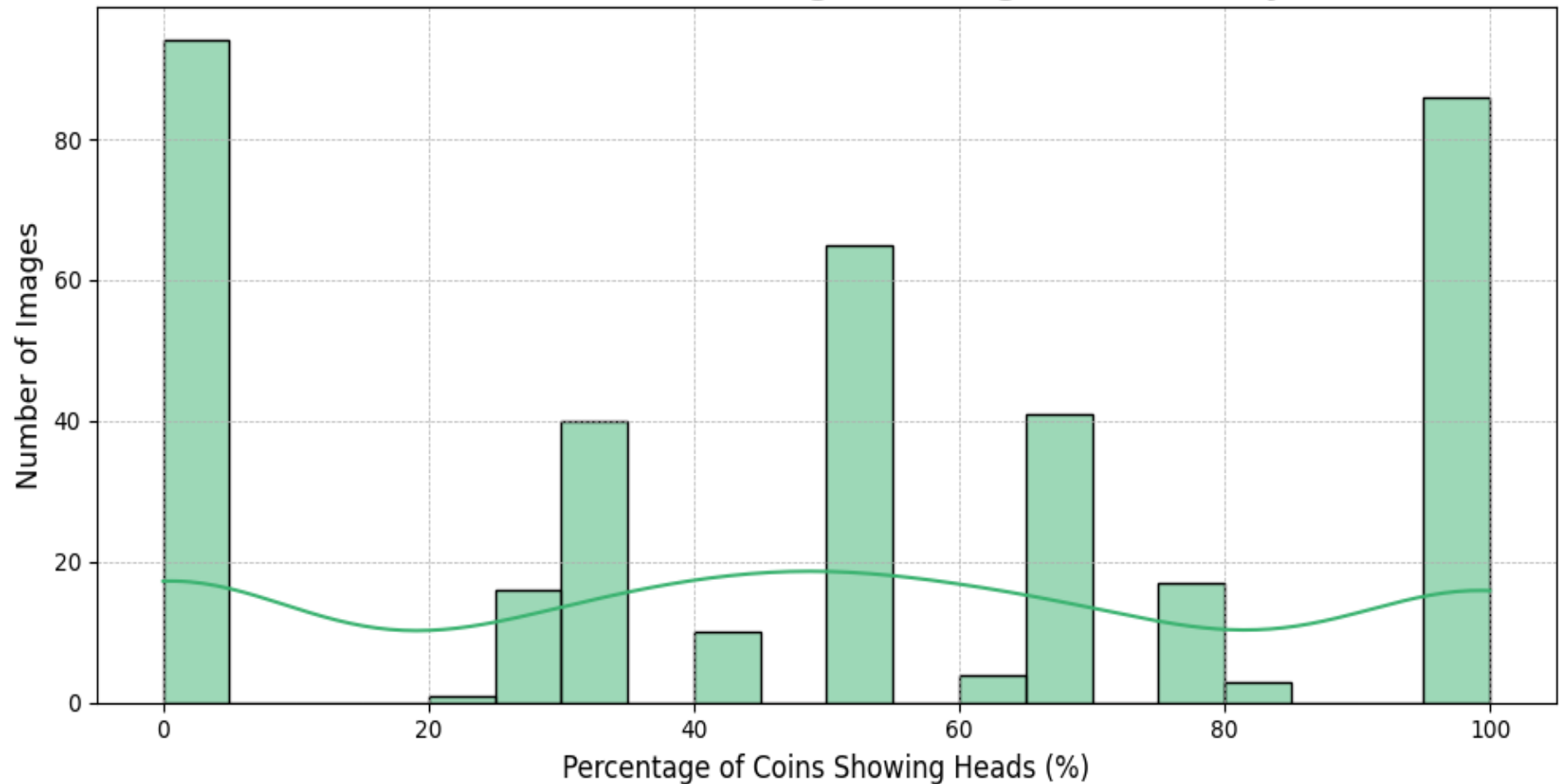
Model Inference

- Ran the trained model on **unlabeled coin crops**
- Model predicted **heads or tails** for each coin
- Grouped predictions by the **original image** each coin came from
- Calculated **% of coins showing heads** per image
- Plotted a **histogram** to visualize distribution
- Some images mostly heads, some mostly tails, some mixed



Visualization

Distribution of Heads Percentage Per Image (Predicted by CNN)



Challenges

- **Unlabeled Dataset:**
Had to manually label coin images for training and evaluation
- **Overlapping Coins:**
Difficult to segment touching coins accurately
- **Unclear Coin Faces:**
Some images were low-quality or blurry, making heads/tails labeling difficult
- **Lack of Pretrained Models:**
Very few existing models for UK coin classification or orientation
- **Small Labeled Sample:**
Only ~150 labeled coins available for training the CNN
- **Class Imbalance:**
Uneven distribution of heads vs tails in labeled data
- **Visual Similarity Between Classes:**
Heads and tails often look similar under poor lighting or angle



Thank you! :)

