Product Categorization for Coupang Catalog

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Motivation/Objective

- Coupang is an international e-commerce platform that hosts billions of sellable items. To ensure those sellers providing images will ultimately provide good catalog quality and a good customer shopping experience, human operators are performing quality control on only a small number of seller listings. But this process can not be scaled as the business grows rapidly. In the project, we are tasked with image quality control for the Coupang marketplace. The objectives include: upsampling low-quality images; detecting and removing imposed watermarks, logos, and graphics; detecting collaged images; counting the number of objects in the image; detecting color chips and zoom-in cuts.
- A pipeline algorithm will be developed to implement all the objectives once each task is completed. Images will pass through the algorithm and be analyzed for various elements.

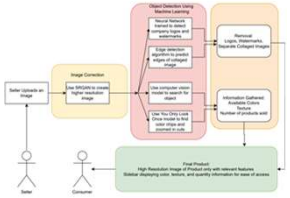


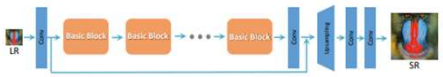
Image Supersampling

- The main objective of this project was to upscale low resolution/blurry images into high res images with a good level of fidelity.
- Used a Generative Adversarial Neural Network Model (ESRGAN) to upscale our models
- A GAN model uses two neural networks: one that is very good at identifying fake (generated) images, and another that generates the actual images.
  - The two models compete against each other. If the generator model can trick the distinguishing model, then our generator model is performing very well

$$D_{Ra}(x_r, x_f) = \sigma(C(x_r) - \mathbb{E}[C(x_f)]) \to 1 \quad \text{More realistic than fake data?}$$

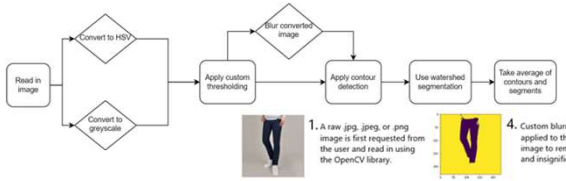
$$D_{Ra}(x_f, x_r) = \sigma(C(x_f) - \mathbb{E}[C(x_r)]) \to 0 \quad \text{Less realistic than real data?}$$

b) Relativistic GAN

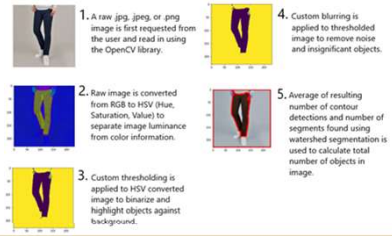


Object Counting

- Main goal for Object Counting is to accurately highlight and count the number of primary objects in an image.
- We decided to use a combination of both contour detection and watershed segmentation to first highlight all primary objects in an image and then to distinguish these highlighted objects from the background.
- The model pipeline (below) shows the process under which each image goes through to determine the number of objects in the image.

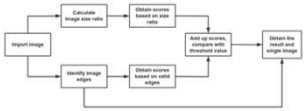


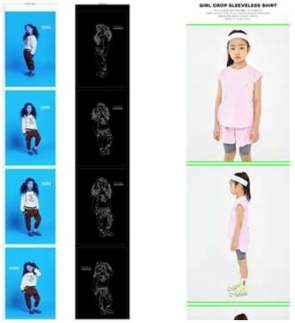
- The diagram to the right shows an example image and visualizations of each step the image takes through the pipeline.



Detecting Collaged Images

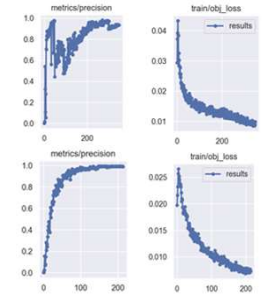
- One of our main goals in the Coupang project is to identify collaged product image so that further image processing can be applied on a single image.
- To realize the target, a collage detection strategy that has been put forward based on the variation of pixel values.
- We improved the current algorithm by balancing the weights of both image size ratio and pixel value variation as well.
- The test on the algorithm has shown consistent results of identifying collage images, even in condition with low color contrast.
- The improved algorithm marks possible edges of single image units as well, which reaches an accuracy of around 80% in given testing samples.
- Sample images to the right show the output of the implemented algorithm.





Object Detection

- Our objective is to implement YOLOv5, built in PyTorch, to detect color chips, zoomed in cuts, watermarks, logos, and imposed graphics.
- We developed a custom dataset, largely from the Coupang website. These images were then manually labeled with the corresponding class using labelIng.
- Each class trained on a few hundred images, on which we trained sufficiently until our precision plateaued.
- Precision and loss diagram (right) for color chips and zoomed in cuts. Our performance was very accurate on color chips, but slightly lower on zoomed in cuts due to the large variety in both texture and shape.
- Precision and loss diagram (right) for logos, watermarks, and imposed graphics. The performance was accurate on logos and imposed graphics, but lower on watermarks due to the great variety of shapes and sizes.



Future Work, References, and Acknowledgments

- Increase the size of the dataset for better accuracy in object detection.
- Host model on Cloud to allow for global execution.
- Tag unique objects/occurrences for object counting.
- Have different models for different levels of upscaling (480o image vs 1080p image)

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