

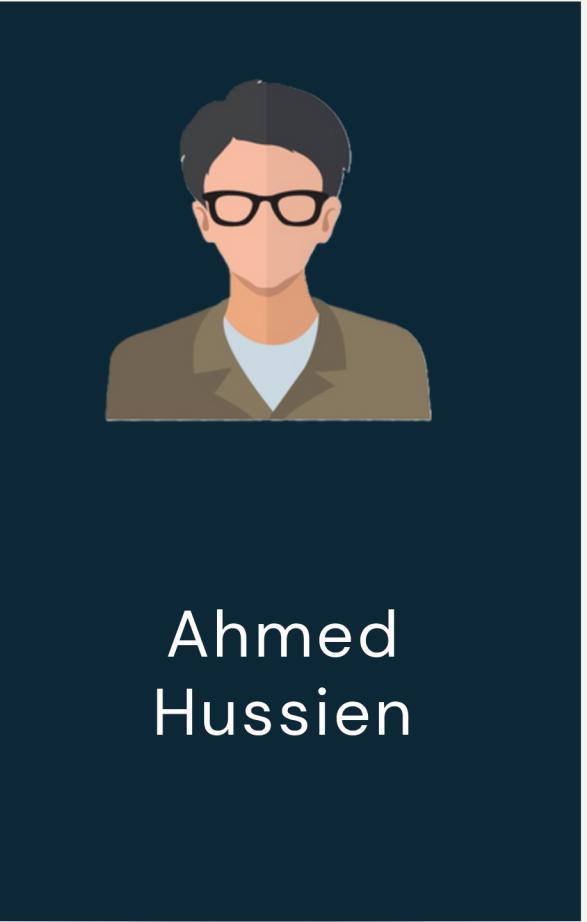
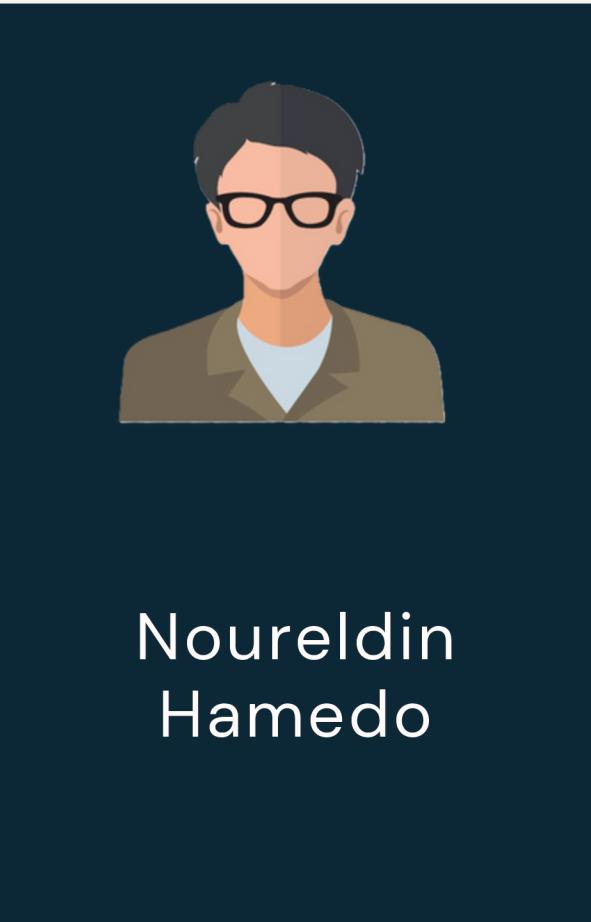


Supervised By: Prof.Davide Yi Xian Hu

ColorEdge: Testing Robustness with Color- Canny ControlNet

Prepared By: Noureldin Hamedo &
Ahmed Hussien

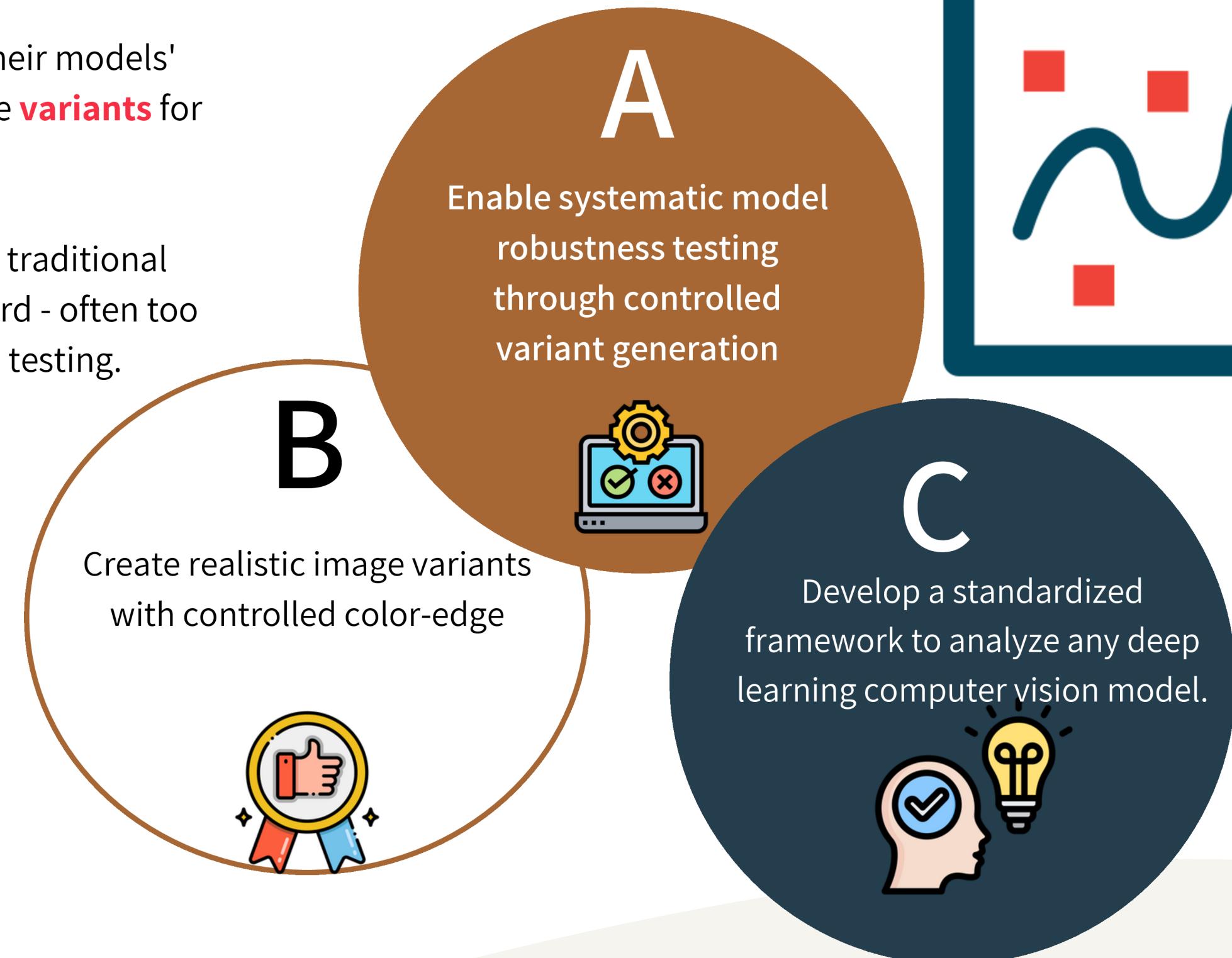
OUR TEAM



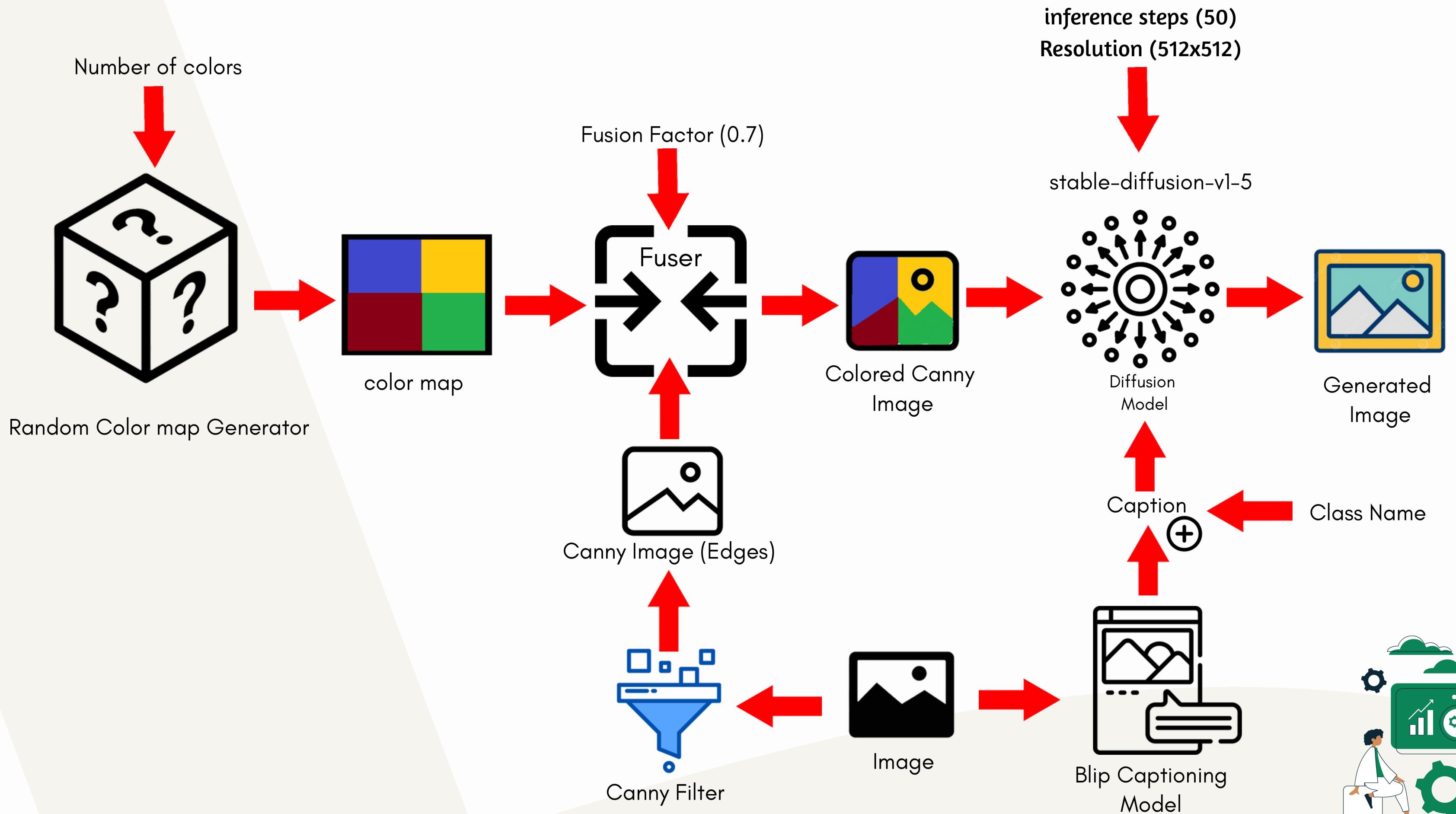
Problem

Data scientists and enterprises **struggle** to test their models' **generalization** ability due to **lack** of realistic image **variants** for robust evaluation.

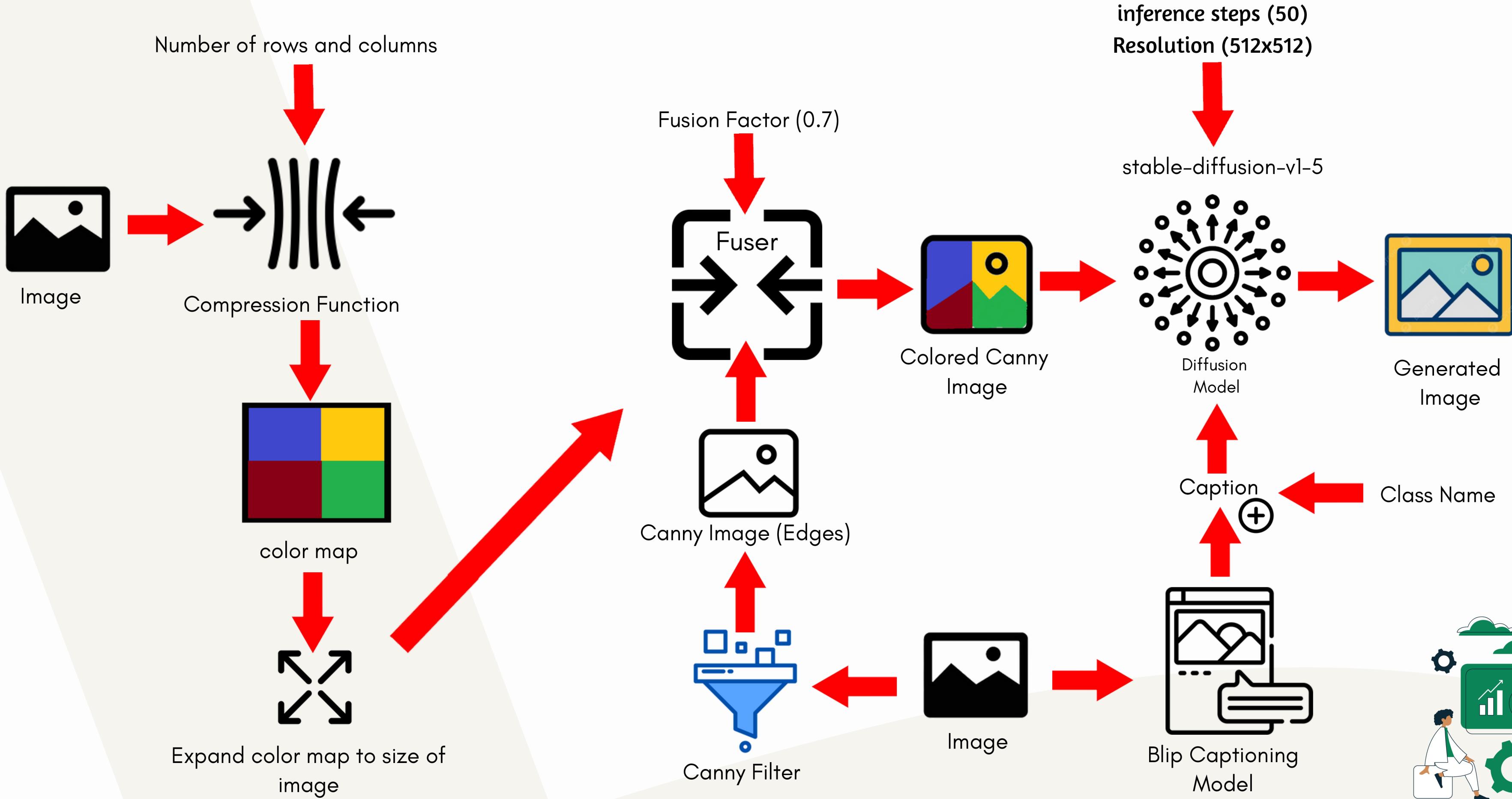
Limited training data leads to **overfitting**, while traditional augmentation techniques are a double-edged sword - often too simplistic or unrealistic for proper robustness testing.



First Approach



Second Approach



Framework

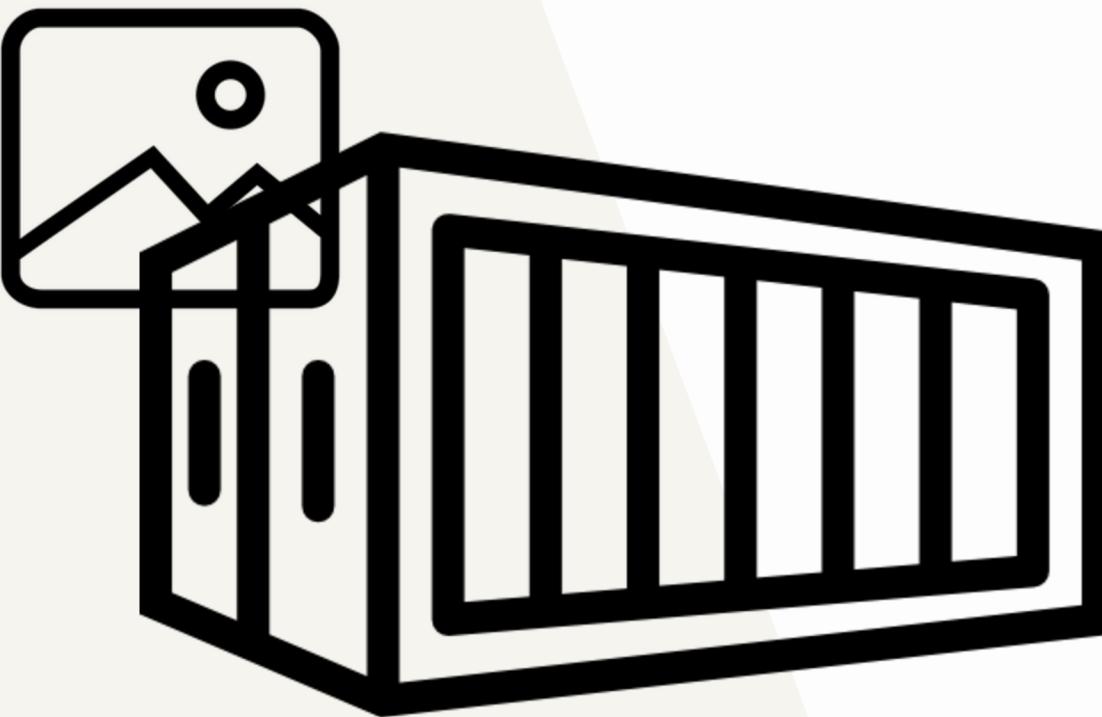


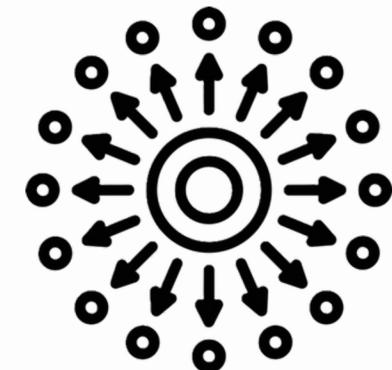
Image Container

- Variants
- Color Maps
- Image
- Label and predicted label
- Image Caption



Color Canny Condition Creator

- Edge Detection
- Color Map Generation



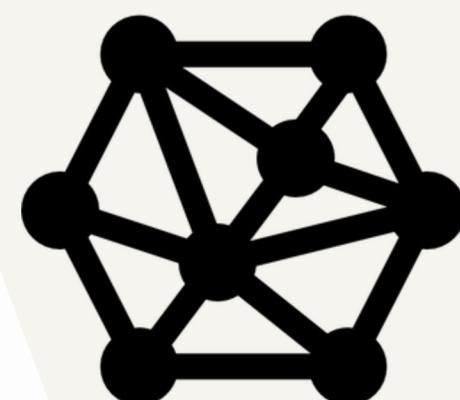
Color Canny Diffuser

- Generate Variants



Image Dataset

- Pytorch compatible
- Dataset Loader
- Load and access image in a directory



Model Holder

- Wrapper for Deep Learning Model



Extra Functionalities

A

Save Generated Color maps



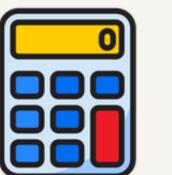
B

Save Generated Variants



C

Calculate and Print Metrics



D

Evaluate Model Robustness given dataset and model

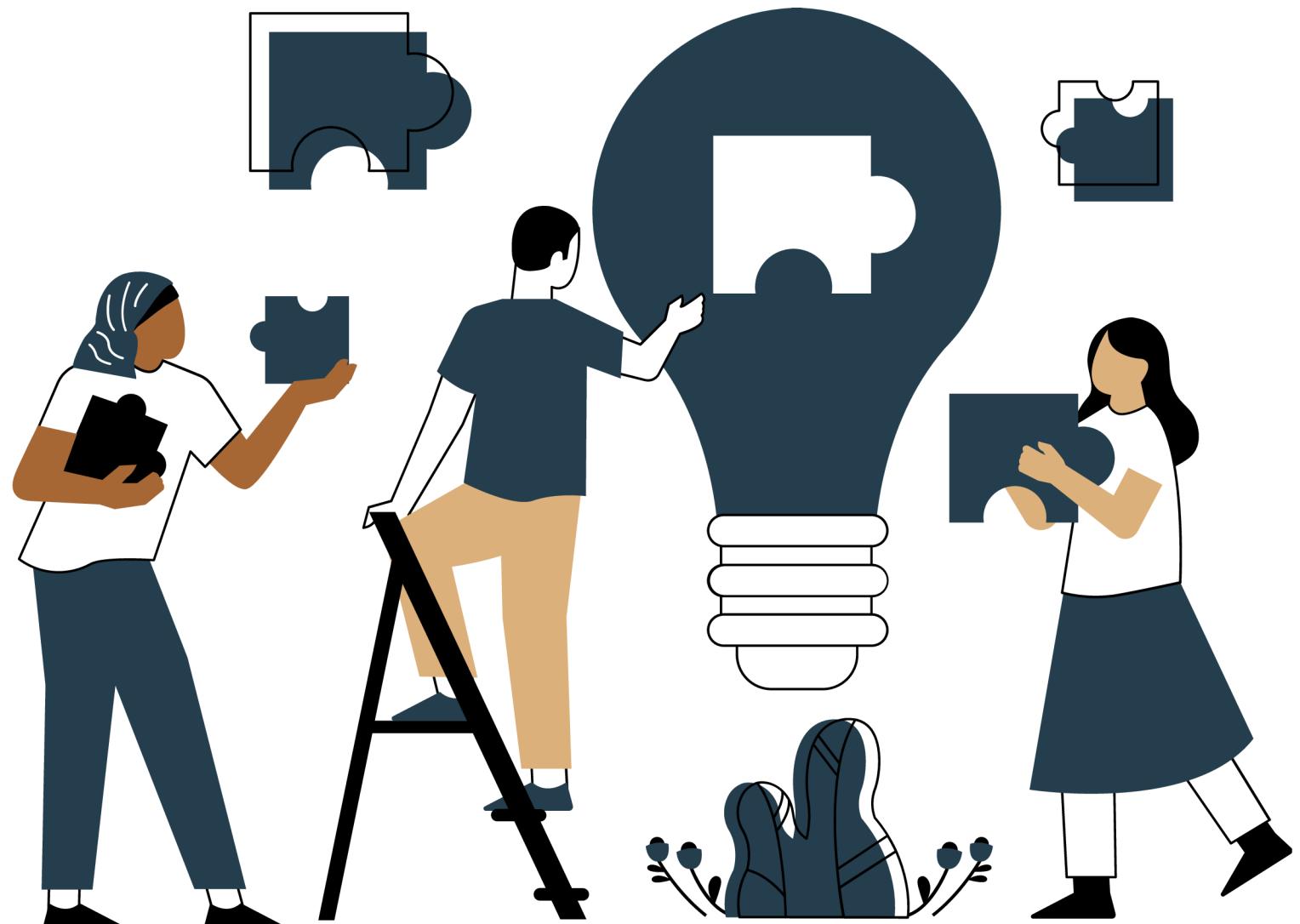


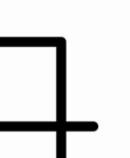
Image Preprocessing



Resize image to **256 pixels** while maintaining the aspect ratio



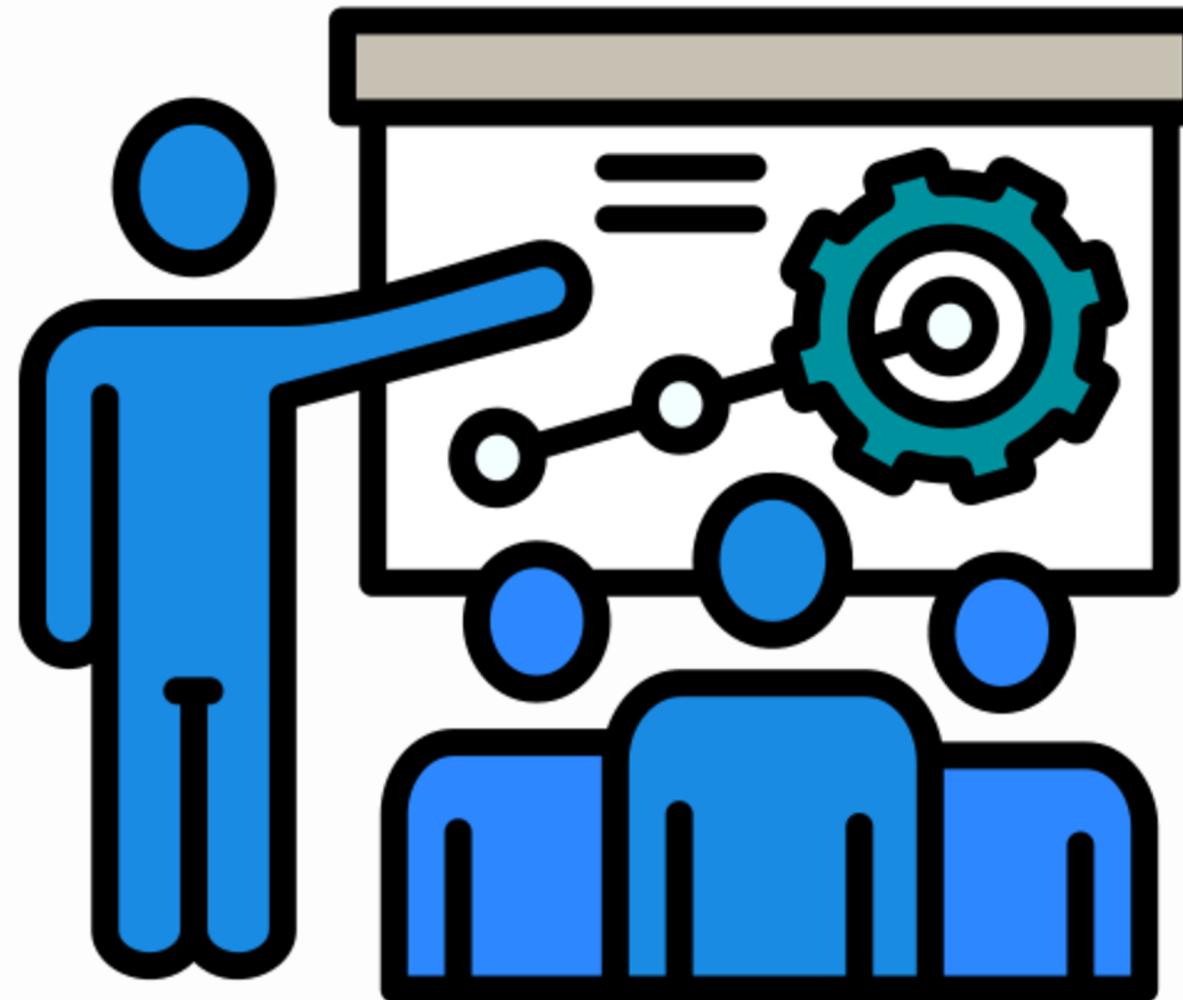
Takes a **224×224** square crop from the center of the resized image.



Converts the image from a **PIL** format **to a tensor**.



Normalizes the color values and **add batch dimension**



Constraints

A

Only pre-trained ResNet18 and VGG19 are evaluated



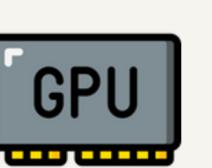
B

Only 3 random images per class from ImageNet used



C

Requires GPU for diffusion-based image generation



D

BLIP captioning model is not the best, but the resources were limited

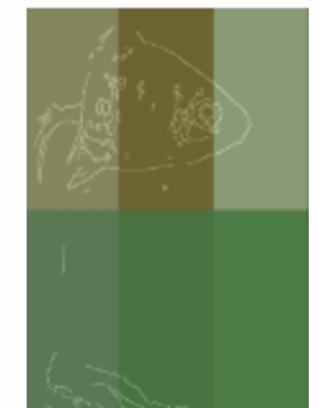
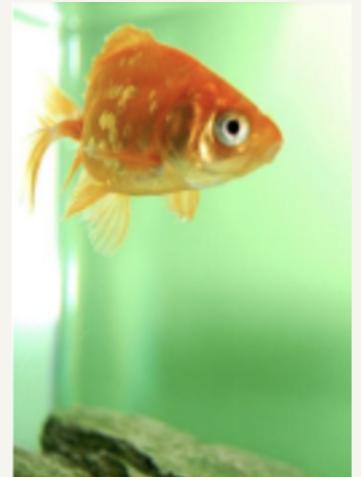


E

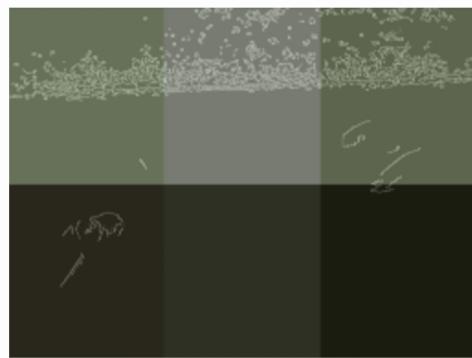
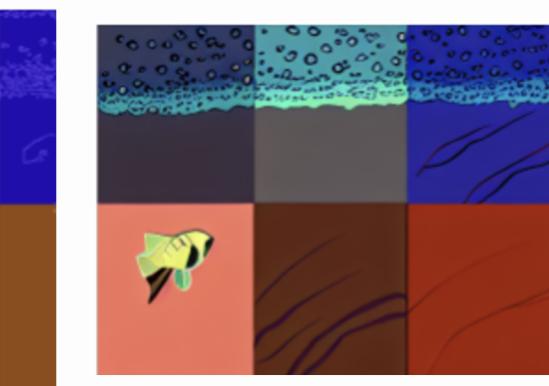
Relying on a single ControlNet (ghoskno) model may introduce potential bias



Results Visualization



**Approach 2 is Performing
better than approach 1
(More correct images are
being generated)**



Approach 1 - Random Color Map

Unrealistic Color maps lead to
unrealistic results

Approach 2 - Compression Color Map



Model Comparison Overview

Approach 1 - Random color maps

Model	Accuracy	Precision	Recall	F1-Score
ResNet18	27.48%	35.36%	29.44%	32.14%
VGG19	25.37%	34.89%	25.37%	29.34%

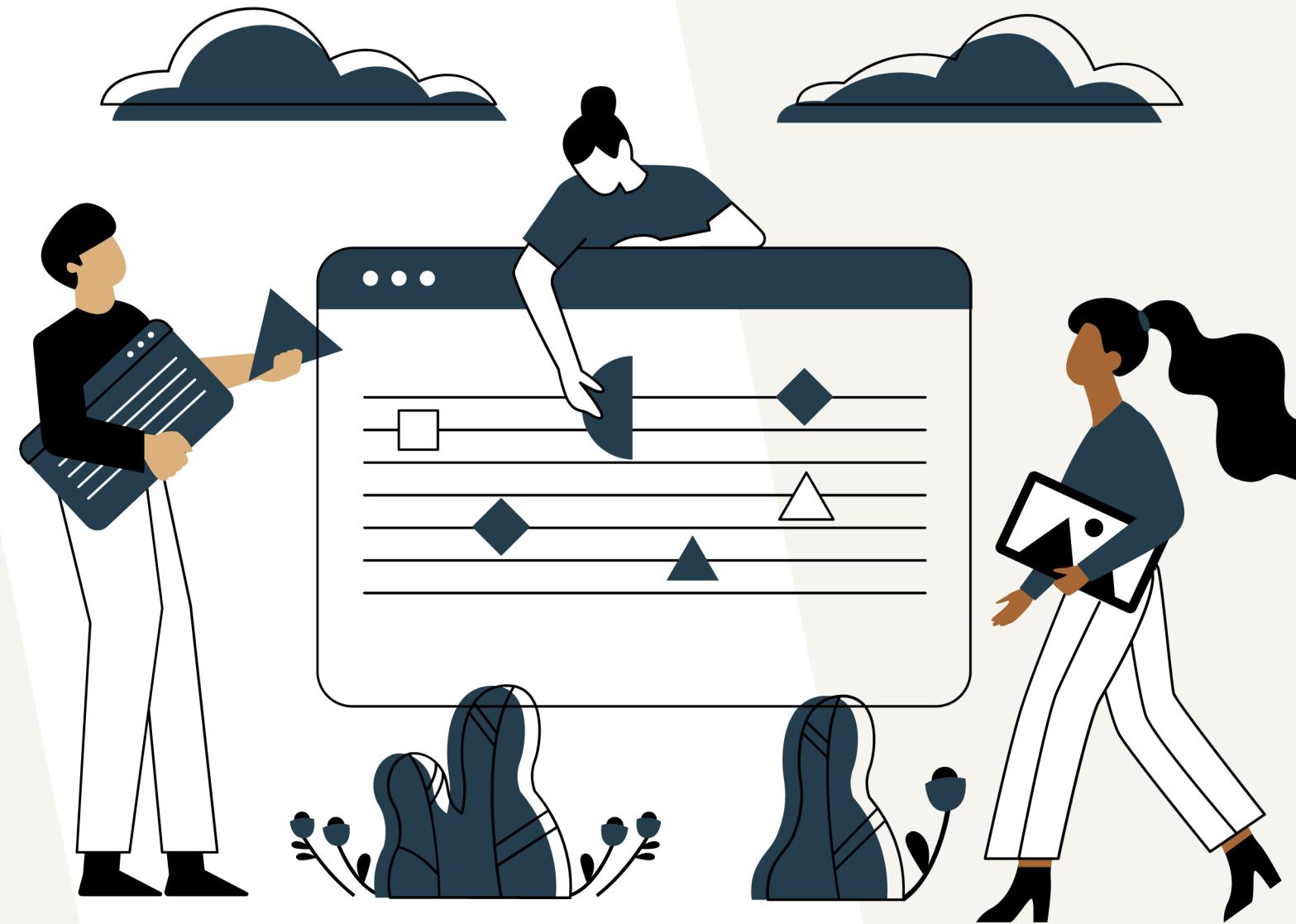
Approach 2 - Extracting Colormaps

Model	Accuracy	Precision	Recall	F1-Score
ResNet18	31.73%	41.97%	31.73%	36.16%
VGG19	28.02%	40.75%	26.94%	32.42%



Resnet Slightly better than VGG, It is more Robust





Questions?

THANK YOU!