Introduction:

Here are short videos to show you what is edge detection:

1. Dynamic Feature Fusion for Semantic Edge Detection (DFF)
2. Finding the Edges (Sobel Operator) - Computerphile
3. Canny Edge Detector - Computerphile

However, the main task of this project is not to detect edges but to do image classification tasks with those edges you detected (with deep learning methods described in the paper [1] and [2]).

Papers:

[1]Dynamic Feature Fusion for Semantic Edge Detection

[2] Dense Extreme Inception Network: Towards a Robust CNN Model for Edge Detection

Problem 1: what is the problem the two papers aim to solve, and why is this problem important or interesting? (5 points)

Problem 2: 1) summarize the two methods, including high-level ideas as well as technical details: the relevant details that are important to focus on (e.g., if there's a model, define it; if there is a theorem, state it and explain why it's important, etc) 2) what are the major differences between the two methods? (15 points)

Problem 3: perform standard image classification with ResNet 18 on the CIFAR-10, CIFAR-100, SVHN, and Tiny ImageNet datasets and report the classification accuracy. (15 points)
Reference code: https://github.com/kuangliu/pytorch-cifar

Problem 4: generate and visualize the edges you detected with [1] on the CIFAR-10, CIFAR-100, SVHN, and Tiny ImageNet datasets. You are allowed to use the pre-trained models provided by the authors. (15 points)
Reference code: https://github.com/Lavender105/DFF

Problem 5: 1) generate and visualize the edges you detected with [2] on the CIFAR-10, CIFAR-100, SVHN, and Tiny ImageNet datasets. You are allowed to use the pre-trained models provided by the authors. (20 points)
Reference code: https://github.com/xavysp/DexiNed
2) combine the edges you detected and the original images to create "edge-enhanced images". You may want to store the edges and the "edge-enhanced images" as datasets, to solve Problem 6 and Problem 7 later. (10 points)

Problem 6: perform image classification with ResNet 18 on the edges of the CIFAR-10, CIFAR-100, SVHN, and Tiny ImageNet datasets and report the classification accuracy. (30 points)

Problem 7: Perform image classification with ResNet 18 on the "edge-enhanced images" of the CIFAR-10, CIFAR-100, SVHN, and Tiny ImageNet datasets and report the classification accuracy. (30 points)

Problem 8: compare the results from Problem 3, Problem 6, and Problem 7. Do you see improvements by using edge information for image classification? Explain why. (10 points)

Problem 9 (bonus): analysis the pitfalls of existing edge detection methods above and come up with one way to address the pitfalls (60 points)