**Mirror Detection**

**Survey 1:** [**Where Is My Mirror?**](https://arxiv.org/pdf/1908.09101.pdf)

**Main Idea of Work:**

The main idea of the work is to propose a new framework called MirrorNet, which helps in segmenting mirrors in images. The framework consists of 3 modules/steps in total:

1. Using a pre-trained neural network (ResNeXt101 network) that extracts multiple-scale feature maps from images.
2. Contextual Contrasted Feature Extraction (CCFE) connected to the pre-trained network, learns different scales of contrasted contextual features for localizing mirrors of various sizes.
3. Mirror map that coarsely highlights the dividing boundaries of the mirror and refines itself by helping the upper CCFE layers to focus on learning finer contextual contrasted features.

**Advantages:**

The main advantage of this proposed network is that this method is the first automatic method for mirror segmentation.

Till then, there was no proper dataset for mirror detection as well. Researchers of this paper have conducted extensive research and gathered a dataset with well-annotated images of mirrors. This is the only paper with its dataset for mirror detection/segmentation.

It is the best compared to the other state of the art algorithms for image segmentation.

**Disadvantages:**

One disadvantage I found is that the dataset consists of mostly internal mirror images. This, I feel, will not be that useful for production-level purposes in autonomous drones/cars. For example, if we take the mirrors in windows of tall buildings, they look entirely different from the normal internal mirrors. So, drones might get confused. Therefore, one way to improve this method is to have a more robust dataset, which also consists of images which cover all possible use cases of autonomous vehicles/robots.

**Survey 2:** [**Progressive Mirror Detection?**](https://www.cs.cityu.edu.hk/~rynson/papers/cvpr20c.pdf)

**Main Idea of Work:**

he main idea of the work is to propose a new module called RCCL (Relational Contextual Contrasted Local). In this, they extract the Relational Contextual Contrasted (RCC) features using from images, and then a decoder is used to decode the extracted features into a mirror map.

In addition to the RCCL module there is another EDF (Edge Detection and Fusion) module to detect mirror edges, from the extracted RCC features.



In addition to the RCCL module and EDF module, there is another module called Refinement module which takes input the original image, and the extracted Boundary Map to output the corresponsing Mirror Maps.

**Advantages:**

The advantage of this method over earlier proposed methods is that, the earlier methods (eg. MirrorNet) used to consider only Contextual Contrasted Features to generate mirror maps. So, if there is a case where the reflection in the mirror is similar to the surroundings, then the earlier proposed methods wont work, because there are no contrasting features in this particular image.  
So, in the present idea of RCCL, they consider both CCF and Relational features, to calculate the mirror maps.

The dataset for the MirrorNet algorithm was not diverse, as it only contained images of interior mirrors. But Researchers of this paper have conducted extensive research and gathered a dataset with well-annotated images of mirrors. It contains images from diverse backgrounds.

It is the best compared to the other state of the art algorithms..

**Disadvantages:**

One disadvantage I found is the paper is that it fails to detect mirrors when humans also fail to detect them. So, the performace is still similar to human vision, where it should be better than humans.

**Related Work and why cant they be used for mirror detection:**

**Salient Object Detection:**

Salient Object Detection is detection of most important or noticeable object in an image. The recent works in Salient Object Detection is mostly based on CNN. They work by applying attention mechanisms for learning global and local contexts or learning background and foreground attention maps to detect salient objects and eliminate non-salient objects.

But, in the case of mirror detection, the objects present in the mirror might not be the most salient part in the image, or even if it is, only a part of it might be salient. So, that is why, the recent improvements in Salient Object Detection might not be useful for Mirror Detection.

**Semantic Segmantaion:**

Semantic Segmantation is an approach to detect, for every pixel, belonging class of the object. Recent works for this include encoder-decoder structure to identify discriminative features for recognizing objects and detecting the boundaries.

But the main disadvantage of using this technology is that, it might also segment the objects present in the mirror and classify them as objects instead of a mirror reflection.

**Shadow Detection:**

It aims to detect shadows from images. According to a [research paper](https://www.sciencedirect.com/science/article/pii/S0924271620302045), they use directon-aware features to differentiate the contrasts between shadow and non-shadow region from an image. But, the contents in and out of a mirror generally have a typically similar intensity.

For mirror detection, we also considered about relational contextual contrasted features to analyse portions around the mirror which might be similar to the objects present in the mirror itself.

That is why, the techniques used for shadow detection might not be helpful for us to use in mirror detection.