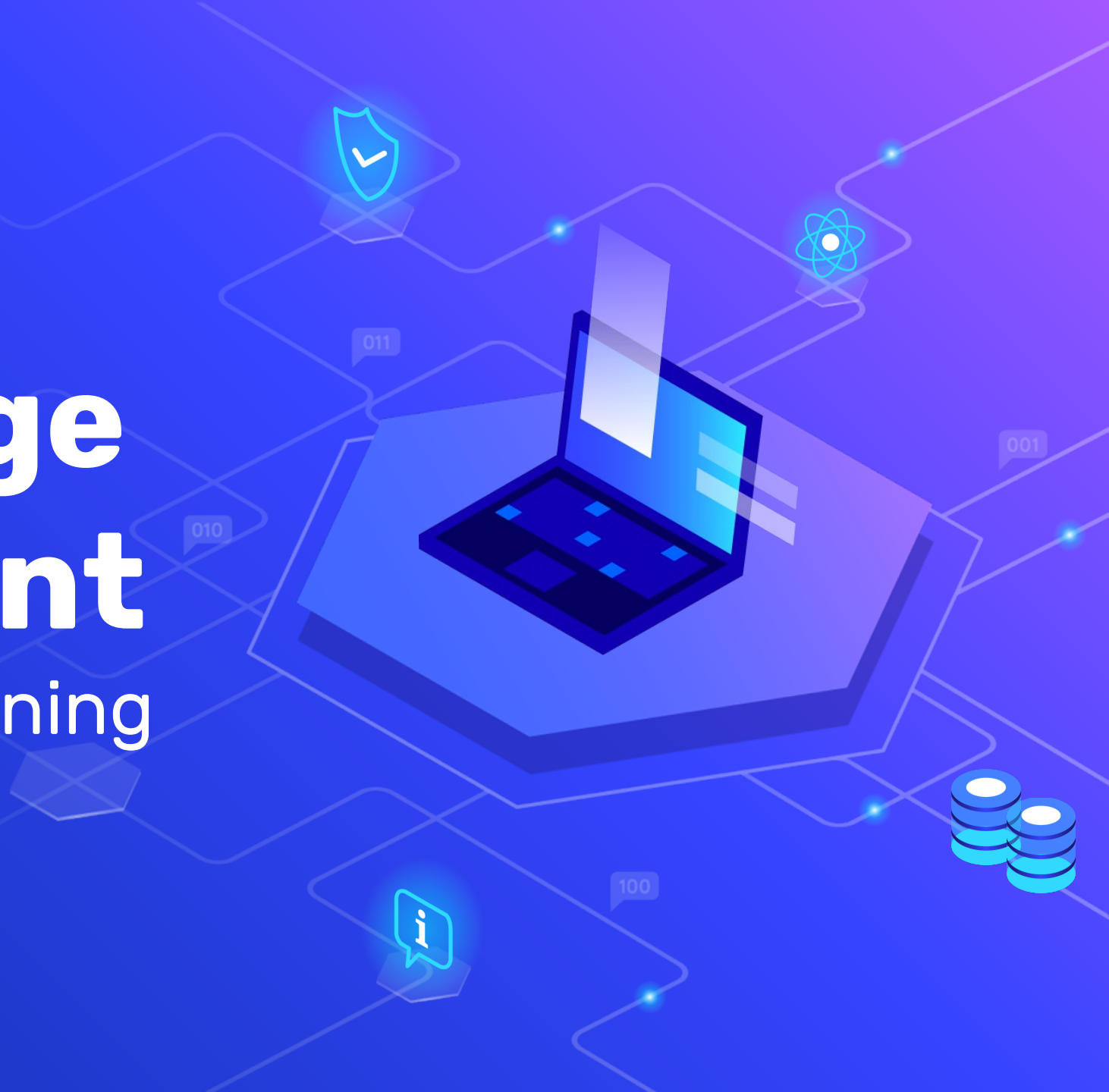


Car Damage Assessment

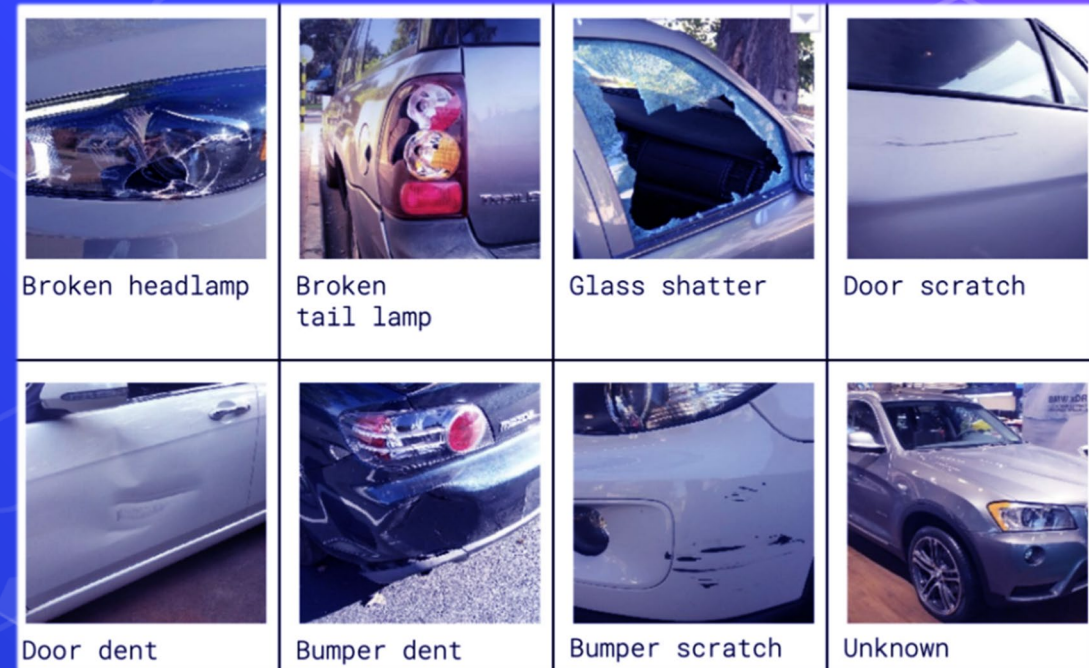
Using Machine Learning



The essence of the database:

The illustration show sample images from the various classes in the dataset.

Note that the unknown class contains images of cars that are in either pristine or wrecked condition.



Door dent: 13% | Unknown: 28% | Head Lamp: 9% | Tail Lamp: 9% | Glass Shatter: 12% | Bumper Dent: 8% | Door Scratch: 13% | Bumper Scratch: 8%

Questions about the database:

- ⬡ What are the success rates in **image** classification?
- ⬡ Is machine learning effective in classifying a large number of classes?
- ⬡ How much does modeling the image into a vector affect learning? (Flatten VS VGG)
- ⬡ How much do image features affect learning?



Algorithms

CNN

A concept of a neural network, Its main attributes may be that it consists of convolution layers, pooling layers , activation layers etc.

CNN

SVM

Works by mapping data to a high-dimensional feature space so that data points can be categorized, even when the data are not otherwise linearly separable. A separator between the categories is found, then the data are transformed in such a way that the separator could be drawn as a hyperplane. Following this, characteristics of new data can be used to predict the group to which a new record should belong

SVM

works by finding the distances between a query and all the examples in the data, selecting the specified number examples (K) closest to the query, then votes for the most frequent label (in the case of classification) or averages the labels (in the case of regression)

KNN

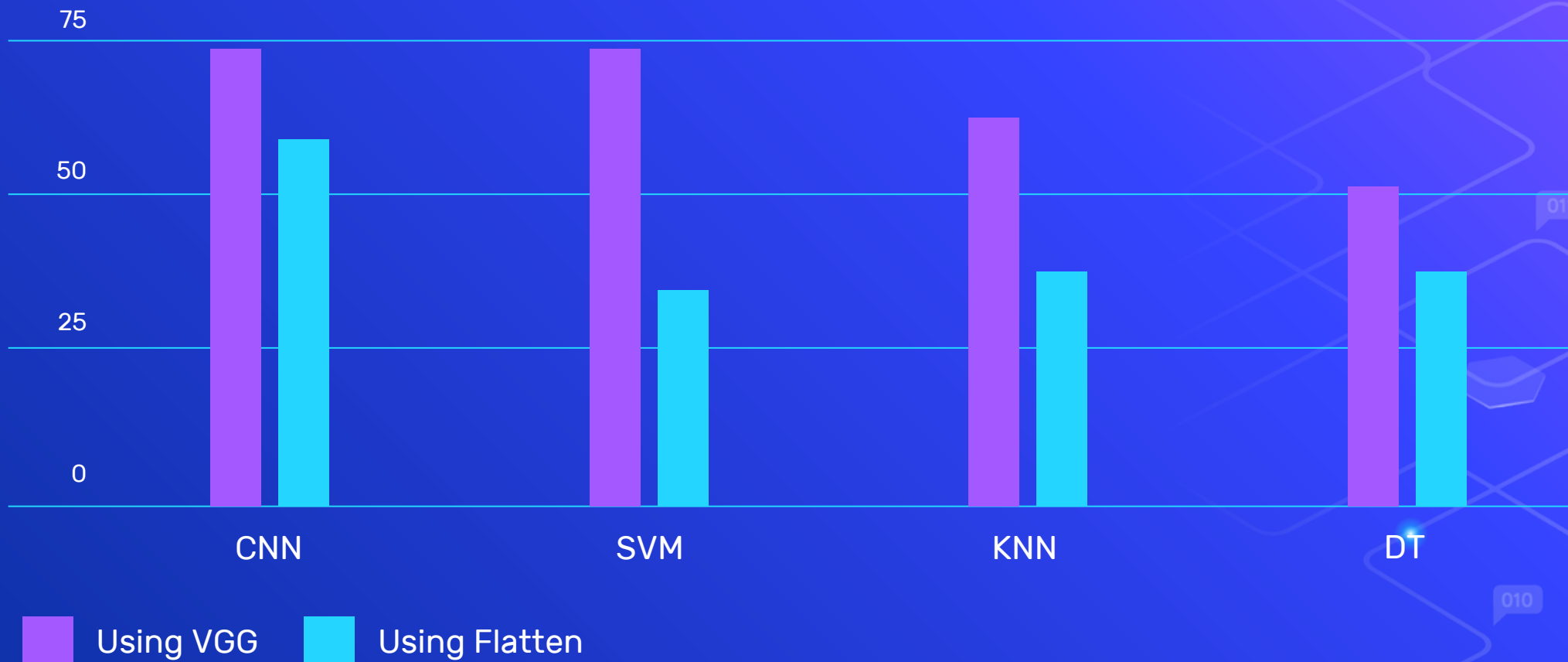
KNN

DT

DT use multiple algorithms to decide to split a node into two or more sub-nodes. The creation of sub-nodes increases the homogeneity of resultant sub-nodes. In other words, we can say that the purity of the node increases with respect to the target variable. The decision tree splits the nodes on all available variables and then selects the split which results in most homogeneous sub-nodes

DT

Results



Main Challenges

- ⬡ **Loss of information obtained from the image columns as a result of performing Flatten (converting the image to vector)**
Overcoming: By using VGG
- ⬡ **Classification into a larger number of classes**
Overcoming: By using larger images that provide more information (224X224)

Techniques

⬡ Bilateral filter

Noise removal while maintaining edges



Gaussian Filter

Bilateral Filter

Techniques

⬡ Sharp Via Laplacian Of Gaussian

Sharpening edges by subtracting the second derivative of the image from the original image



Original



Sharpen

Techniques

⬡ Canny

Finding the edges by the first derivative of the image and filtering the results with the assumption that the edges are long and connected together (using angles)



Original



Edges

Techniques

⬡ Histogram Equalization

Increasing image contrast (larger changes between pixels)



Before



After

Techniques

White Balance

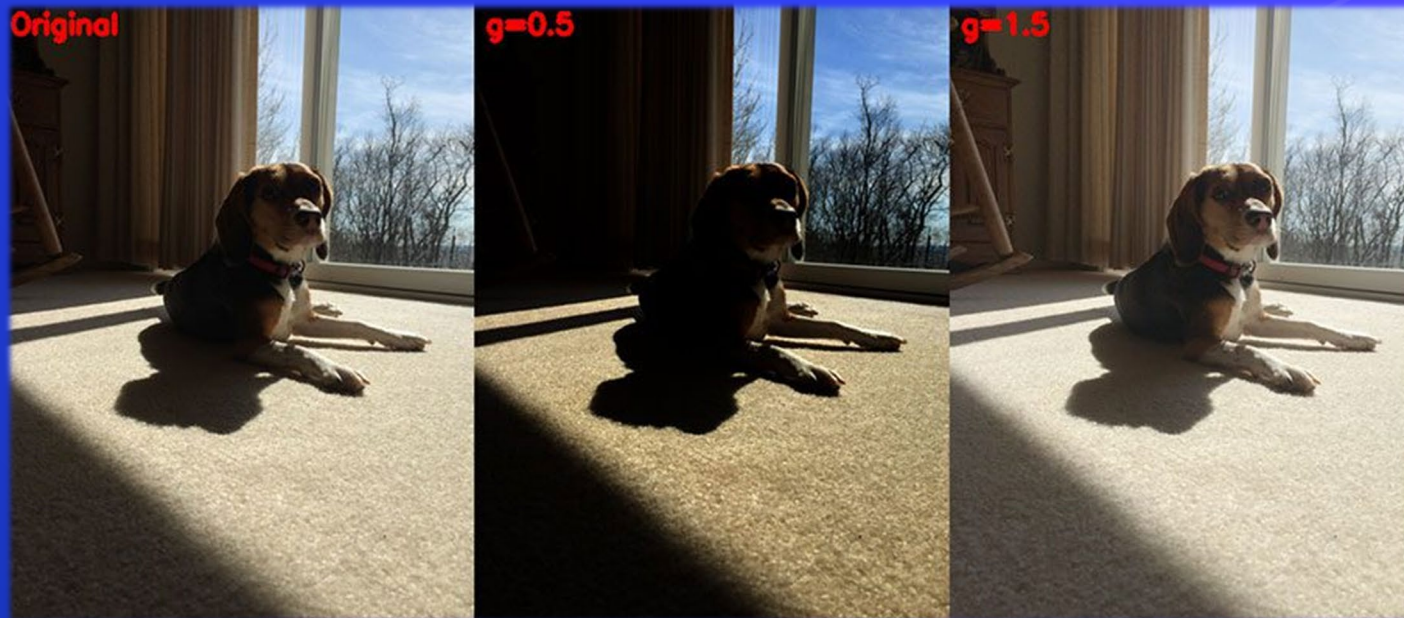
Corrects the color appearance of the image based on the white color



Techniques

⬡ Gamma Correction

Change the brightness of the image



Techniques

⬡ HSV

Color space that defined by hue (color range),
saturation (darkness range), value (brightness range)



RGB

HSV

Techniques

⬡ BGR

Color space similar to RGB color space but in reverse layout



RGB

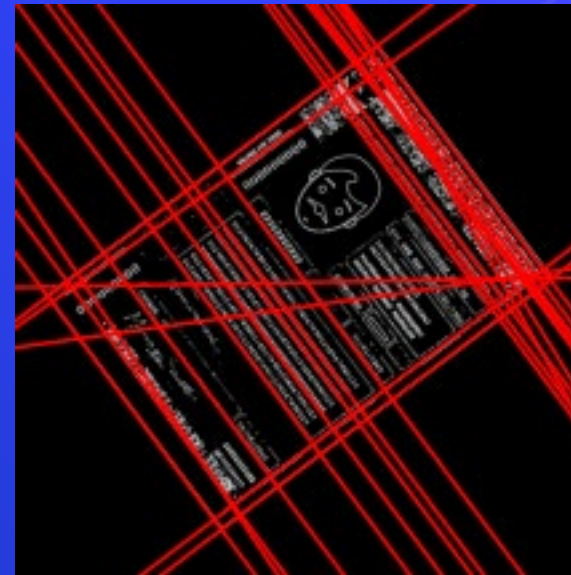


BGR

Techniques

⬡ Hough Line Transform

Finding a parametric shape (characterized by parameters like line) by mapping each edge pixel to a new space whose dimensions represent the shape parameters

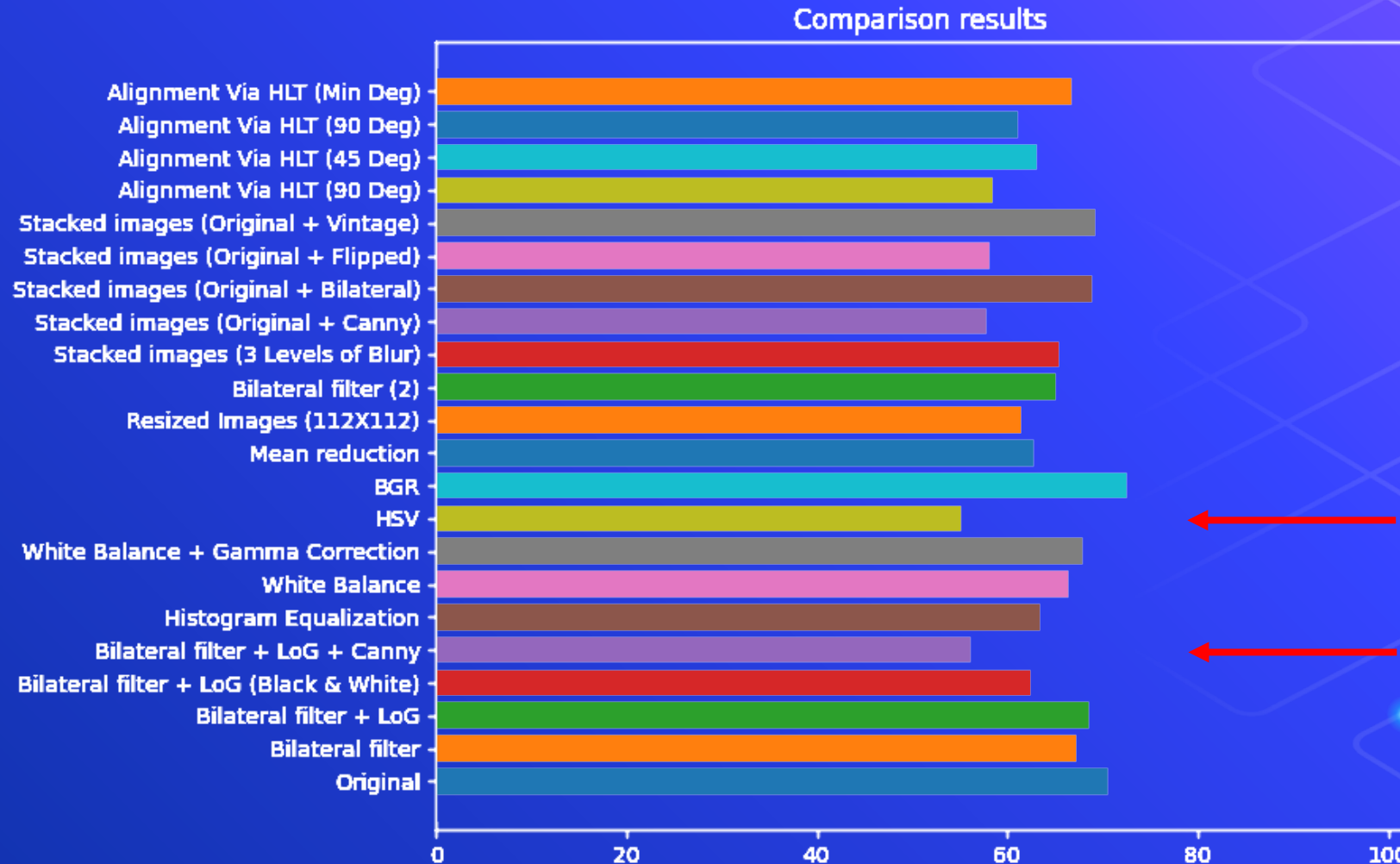


Techniques

... And more tweaks like:

- ⬡ **Mean reduction**
- ⬡ **Resized Images (112X112)**

Techniques Results



Analysis Of The Techniques

- ⬡ **Hough Line Transform** - Loss of information of the image corners as a result of rotation
- ⬡ **Stacked Flipped Image** - Increasing the number of features leads to inaccuracy
- ⬡ **Using Canny** - Over-adjustment to a specific image as a result of highlighting the objects
- ⬡ **HSV** - Loss of color distribution (to a smaller number)
- ⬡ **Histogram Equalization** - Loss of color matching between images due to minimum and maximum value
- ⬡ **Black & White** - Loss of information due to image colors
- ⬡ **Image Reduction** - information loss / aliasing

Credits

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Thanks!

