# Tino Puzzle Pieces - Reflection

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## 1. Data Preprocessing and Cleaning

The data consisted of 48x2 puzzles (RGB + MASKS)

The data was clearly not balanced and there were some masks which have white background and many have black background We also should remove any duplicates and then replaced it with a self-annotated mask using Label Studio I would say this is the most important step in the whole process of solving the puzzle and segmenting it.

More data and less biased data helps a long way. I would also have a ground truth human level dataset with labels for each puzzle and it's mask and how accurate they think it is. More data augmentation is better I feel and gives the models more data to work with and perform according to their strengths.

1. Rotation
2. Width height shifts
3. Brightness
4. Shear transformation
5. Zoom
6. Channel Shift
7. Flipping
8. Normalization

## 1.1. Train, test split

Divided the puzzle images into training (70%) training and analysis in the tasks below. This works out to 34 training images, 7 validation and 7 test images. Since Deep learning is data hungry, we fed the 34 training images into a data augmentation pipeline to enlarge the size of our training data to 200 images, keeping the validation and test size same. This might not always work best.

## 2. ROC, AUC Metrics

We need the Use of different metrics other than ROC AUC score. IOU, dice coefficient, pixel accuracy, etc are definitely something to look into for future pipelines.

Ways to reduce bias and variance.

First, the AUC is not sensitive to class imbalance which is common in semantic segmentation datasets. Second, the AUC can be used even when there are multiple classes present in an image (multi-class). Finally, the AUC provides a single value that represents overall performance on an entire dataset which makes it easier to compare different models or different methods for training a model.

Despite its advantages, there are some limitations to using the AUC for evaluation. One limitation is that it does not consider localisation information such as whether or not a predicted bounding box contains an object of interest within it. A new method to do that is Leveraging global and contour accuracy -

Leveraging global.

## 2.1. Discussion

## 2.2. MODEL ARCHITECTURE

1. Use of Advanced architectures like MaskRCNN and DeepLab would significantly give good performance in short amount of time.

2. Make use of Batch Normalization Usage of L2 Regularization to curb overfitting especially in small datasets.
3. Selecting Features via PCA works best and we should visualize them via TSNE and also use GMM in conjuction with U-net to explore how they work well with each other.
4. Figure out the appropriate loss function, try out triplet loss as well. 5. Tweaking hyperparameters(Batch size, learning rate, etc.)

## 3. Conclusion

A stable data preprocessing pipeline with ample data and measures to curb bias and variance and doing cross-validation on data and using the latest architectures with proper metrics would be an appropriate pipeline for the Puzzle segmentation task.