REPORT ON MANUFACTURING CASTING PRODUCT QUALITY PREDICTION

GITHUB LINK:

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AIM OF THE PROJECT :

- The aim of the project is to develop a model or system that can accurately predict the quality of manufacturing casting products.
- This could involve using various data sources, such as historical manufacturing data, sensor data, or input variables related to the manufacturing process, to train a machine learning model.
- The goal is to identify patterns and relationships between these variables and the resulting quality of the casting product, and use this information to predict the quality of future products.
- This could help manufacturers optimize their processes, reduce waste and defects, and ultimately improve the quality of their products.

MOTIVATION OF THE PROJECT :

- There are several motivations behind the project of manufacturing casting product quality prediction.
- One of the main motivations is to improve the quality of the casting products being produced.
- Poor quality casting products can result in safety hazards, product failures, and customer dissatisfaction.
- By predicting and identifying potential quality issues early in the manufacturing process, manufacturers can take corrective actions to ensure that the final products meet the desired quality standards

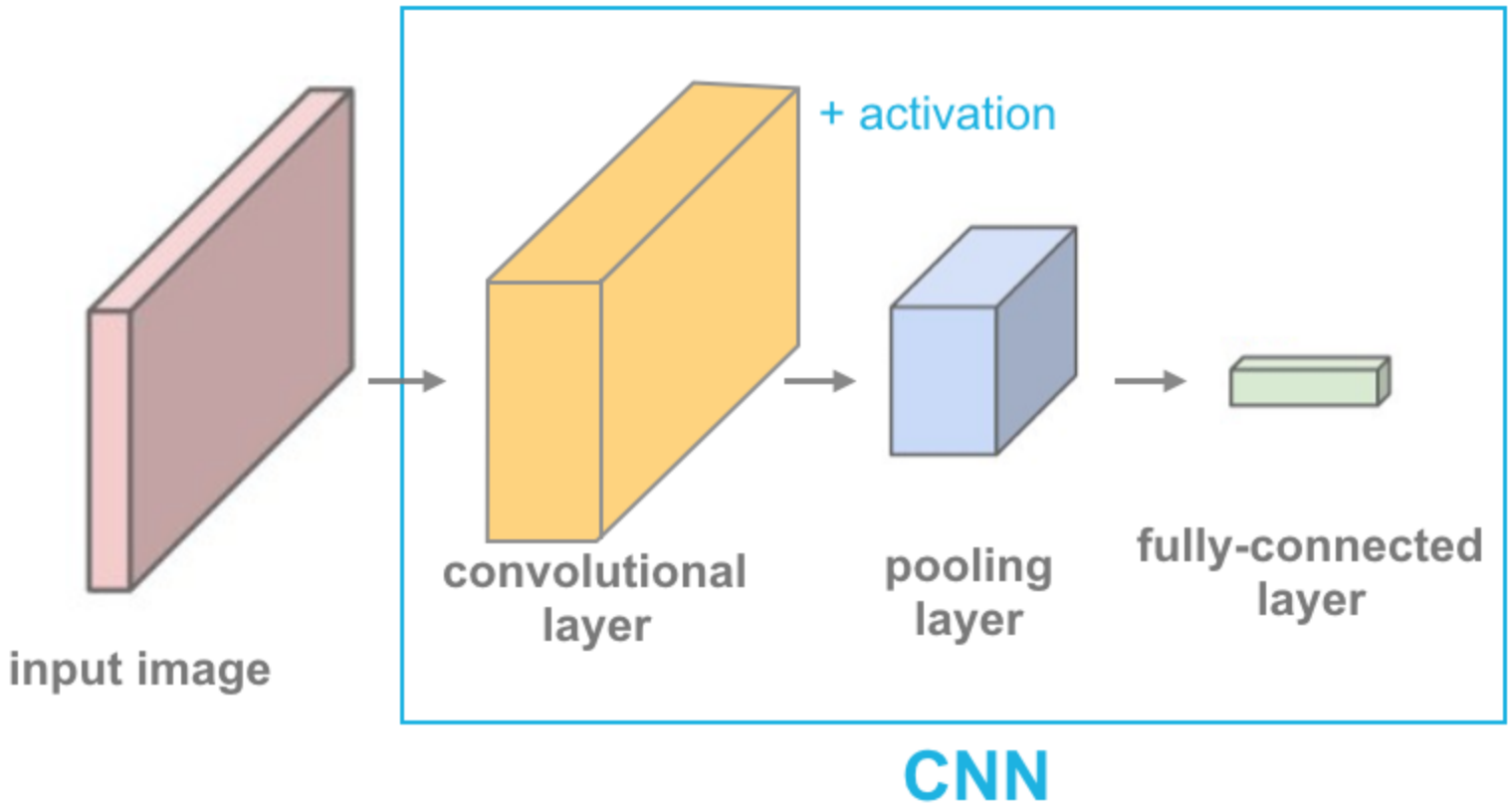
DATASET :

- The dataset have casting images on casting manufacturing consisting of defet and non-defect image.

EDA OF THE DATA

- Image Data Proportion
- Training Evaluation

ML MODEL :


+ activation
input image
convolutional layer
pooling layer
fully-connected layer
CNN

TRAINING EVALUATION :

METRICES :

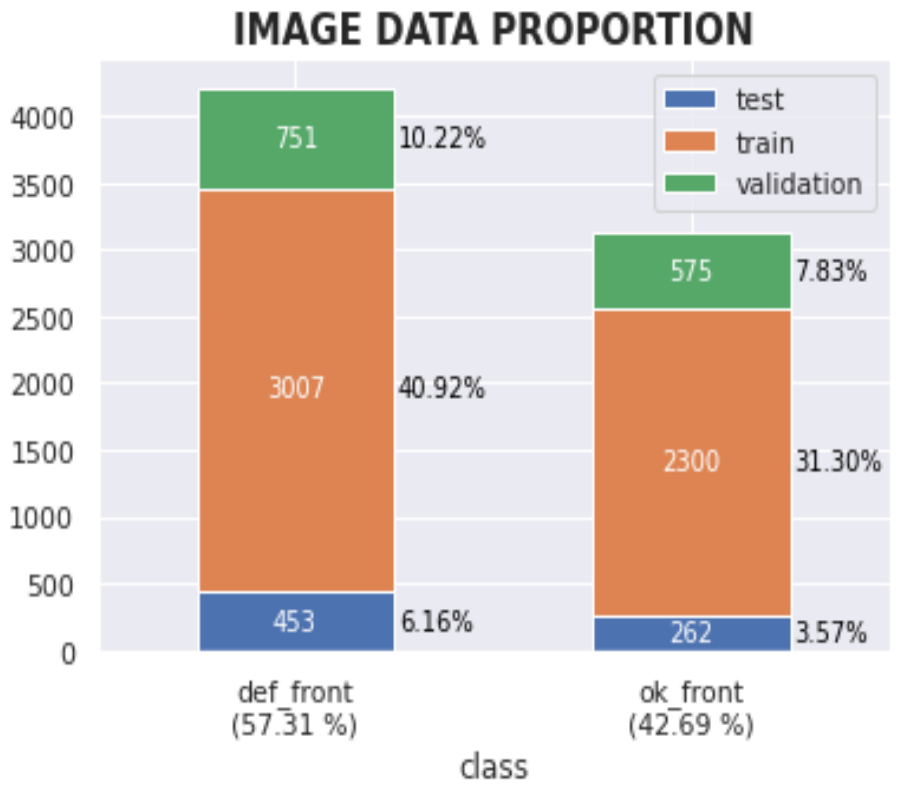


IMAGE DATA PROPORTION
test
train
validation
4000
3500
3000
2500
2000
1500
1000
500
0
751
10.22%
3007
40.92%
453
6.16%
575
7.83%
2300
31.30%
262
3.57%
def_front
(57.31 %)
ok_front
(42.69 %)
class

INFERENCE REPORT :

- The output of the prediction is in the form of probability. We use THRESHOLD = 0.5 to separate the classes.
- If the probability is greater or equal to the THRESHOLD, then it will be classified as defect, otherwise ok.

SCOPE OF ENHANCEMENT :

Here are some areas where the model could be enhanced:

- Feature engineering: The performance of the model can be improved by selecting the most important features that have the highest correlation with the target variable. This can be done using feature selection techniques such as Recursive Feature Elimination (RFE) or Principal Component Analysis (PCA).
- Hyperparameter tuning: The performance of the model can be further improved by fine-tuning the hyperparameters of the model. This can be done using techniques such as grid search or random search to find the best combination of hyperparameters.
- Model architecture: The model architecture can be enhanced by using more complex models such as deep neural networks. This can help to capture more complex relationships between the features and the target variable.
- Data augmentation: The performance of the model can be improved by using data augmentation techniques to increase the size of the dataset. This can be done by creating new samples by rotating, flipping, or scaling the existing data.
- External data: The model can be enhanced by incorporating external data such as weather data or market trends that may impact the quality of manufacturing casting products.

CONCLUSION:

- By using CNN and on-the-fly data augmentation, the performance of our model in training, validation, and test images is almost perfect, reaching 98-99% accuracy and F1 score.
- We can utilize this model by embedding it into a surveillance camera where the system can automatically separate defective product from the production line.
- This method surely can reduce human error and human resources on manual inspection, but it still needs supervision from human since the model is not 100% correct at all times.