

PROJECT SUMMARY

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What is Casting?

Casting is a manufacturing process in which a liquid material is usually poured into a mold, which contains a hollow cavity of the desired shape, and then allowed to solidify.

Types of casting defects:

1. Gas Porosity: Blowholes, open holes, pinholes
2. Shrinkage defects: shrinkage cavity
3. Mold material defects: Cut and washes, swell, drops, metal penetration, rat tail
4. Pouring metal defects: Cold shut, misrun, slag inclusion
5. Metallurgical defects: Hot tears, hot spot. Etc.

Objective of this project:

The objective of this project is to automate the process of finding defects in the casting process. A casting defect is an undesired irregularity in a metal casting process. For removing this defective product all industries have their quality inspection department. But the main problem is that this inspection process is carried out manually. It is a very time-consuming process and due to human error, the process of rejecting defects is not 100% accurate. This can be the cause of rejection of an entire order which would lead to huge losses. Our model will try to eliminate this loss of revenue and make the QC process as accurate as possible.

Dataset used for this project:

<https://www.kaggle.com/datasets/ravirajsinh45/real-life-industrial-dataset-of-casting-product>

Type of data:

The problem is an image classification problem. We have a train dataset having 6633 images and test dataset of 715 images

Type of problem:

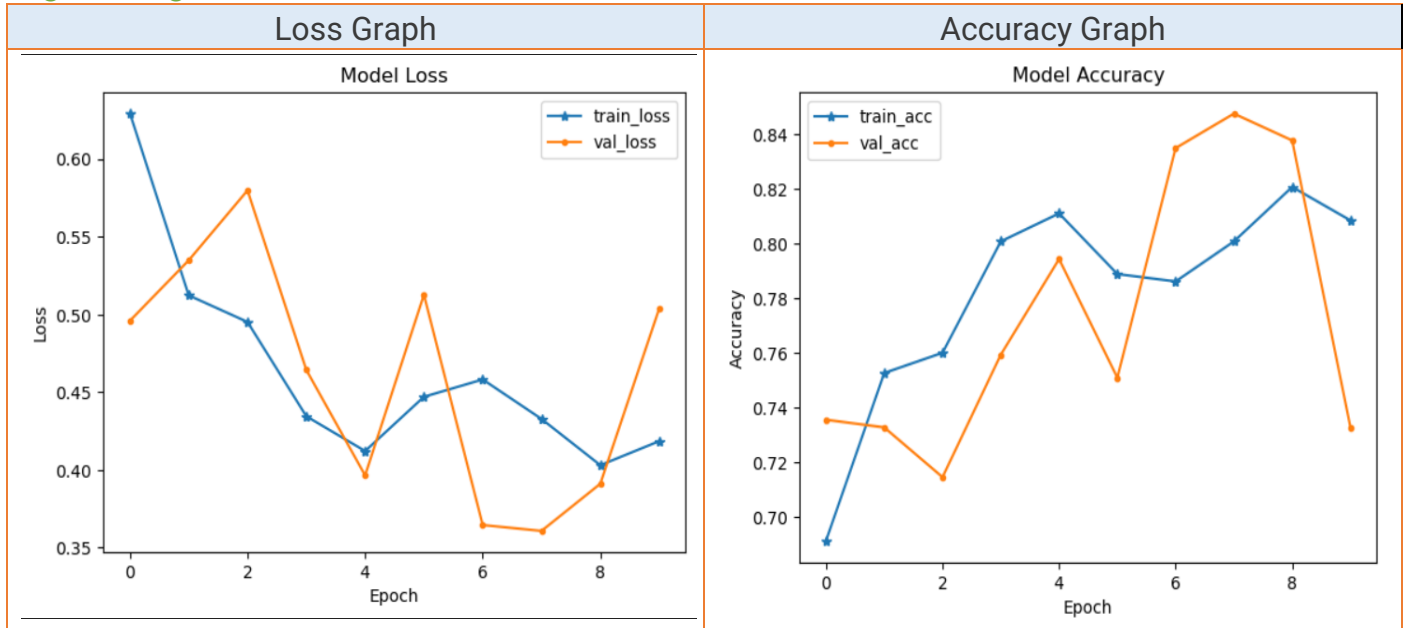
Image classification with two outputs.

Modeling:

Type of model	Batch size	Number of epochs	Accuracy (on test data)	Notebook
Logistic regression	32	10	73.29	LR Model
CNN	32	10	99.58	CNN Model

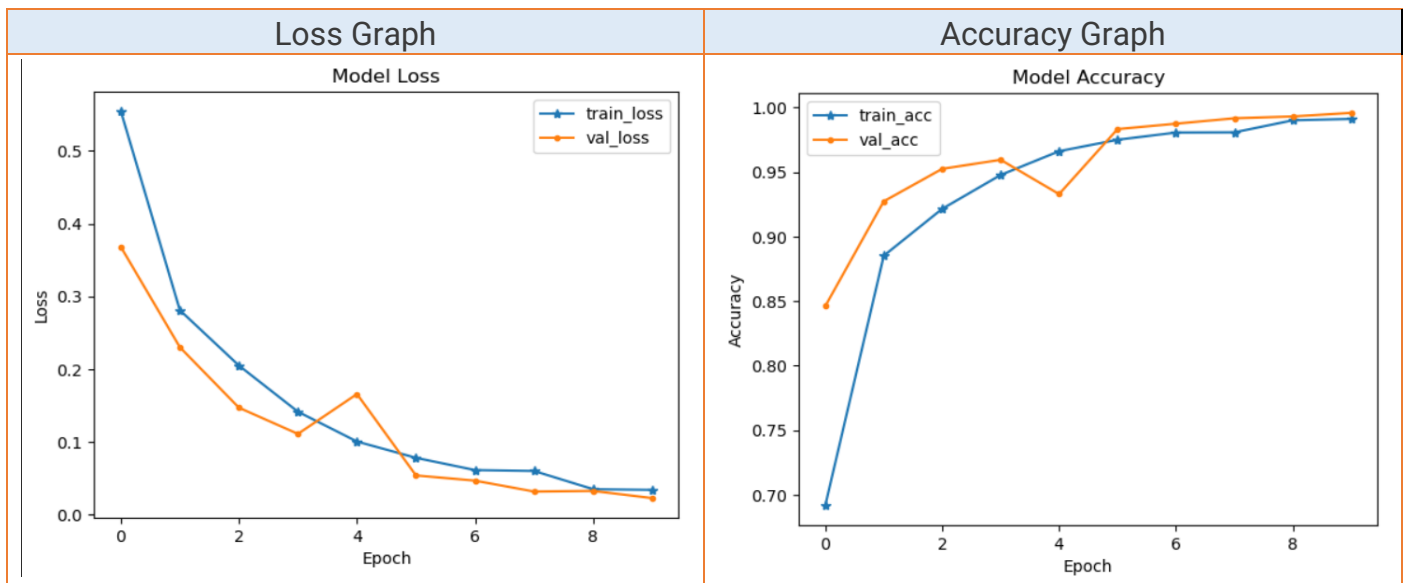
Observations:

Logistic Regression



- The training using the logistic regression was very erratic compared to other models.
- We got the least accuracy of 73.29% on the test set using logistic regression which was expected.
- Logistic regression performs better when the data is text based and not image based.

Convolutional Neural Network



- CNN had to do better than the traditional neural network because it is known for image classification problems.
- It slides a 'nxn' matrix specified by us over the entire image and assigns weights. Read [here](#) to know more about CNN.
- We were able to achieve an amazing accuracy of 99.58% on the test set.
- This high accuracy was probably because we had only two classes and secondly the inspection is of only one part. Hence there is more uniformity between the images and it is easier to detect faults.

Conclusions:

This project helped me understand how useful deep learning and image classification can be in real industries. Inspection and quality control is an aspect I have observed in all my past internships. Whether it be with robotic systems or welding processes. An advantage of ML and DL models is that it can be implemented on other image sets with minimal changes. This makes it much more advantageous and is now the new way of programming.

For future work, this project could be a game changer for quality control in heavy machinery industries. However, adopting this in the industry could take some time due to infrastructure requirements like cameras and a set process which would automate the Quality Control process.