PROOF OF CONCEPT (POC)

Title: Development of vision based semantic segmentation system to detect & segment porosity in aluminum alloy wheel.

Background:

Pune based manufacturing company facing problem which is discussed below.

Problem Statement:

A Pune based company producing aluminum alloy wheels for two wheelers. In casting it is difficult to maintain process parameters such as alloy percentage, temperature as per standard which causes porosity or blow holes in casting. We can't check porosity inside a wheel by eyes. If wheel with high porosity is assembled to vehicle and due to impact to wheel while going through pothole can create crack in wheel which may lead to serious accident. So, to avoid this we have to check porosity level through XRays.

Objective:

Build semantic segmentation system to segment porosity level in aluminum alloy wheel Xrays & analysis dashboard.

Solution:

This is computer vision project and can be solved using deep learning.

From AI stack, to process images we can use computer vision deep learning model with neural network architecture to perform porosity level detection & classification approach to separate the wheels. Using Python programming language and frameworks such as Numpy, Pandas, Scikit-learn, TensorFlow, Keras, to build the whole model.

Technology:

Frontend	HTML/CSS
Backend	Python
Database	MongoDB
Framework	Flask
Deployment	AWS

Steps:

Step 1:

- Perform understanding of problem & constraints
- Requirement gathering for model training & testing

Step 2:

- Development of frontend using HTML/CSS for interaction
- Development of backend ie deep learning model
- Integration of frontend with backend

Step 3:

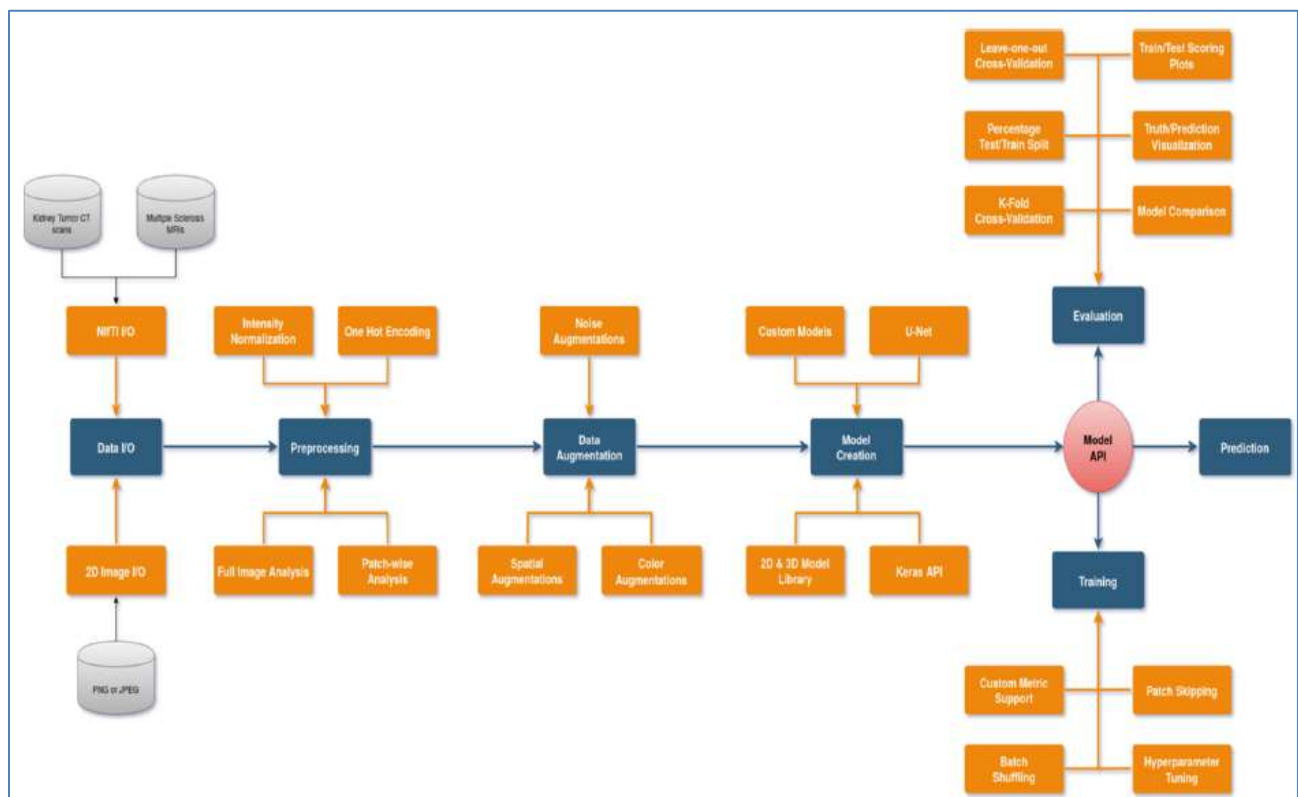- Dashboard creation for statistical & graphical analysis of detection.

Step 4:

- Development of test cases
- Testing with sample images

Step 5:

- Deployment to cloud platform if required

Model training/validation workflow:

Implement U-Net architecture as we require semantic segmentation for the porosity diagnosis. U- Net is a Fully Convolution Network architecture used for Semantic Segmentation of images.

Probable Functional Architecture:
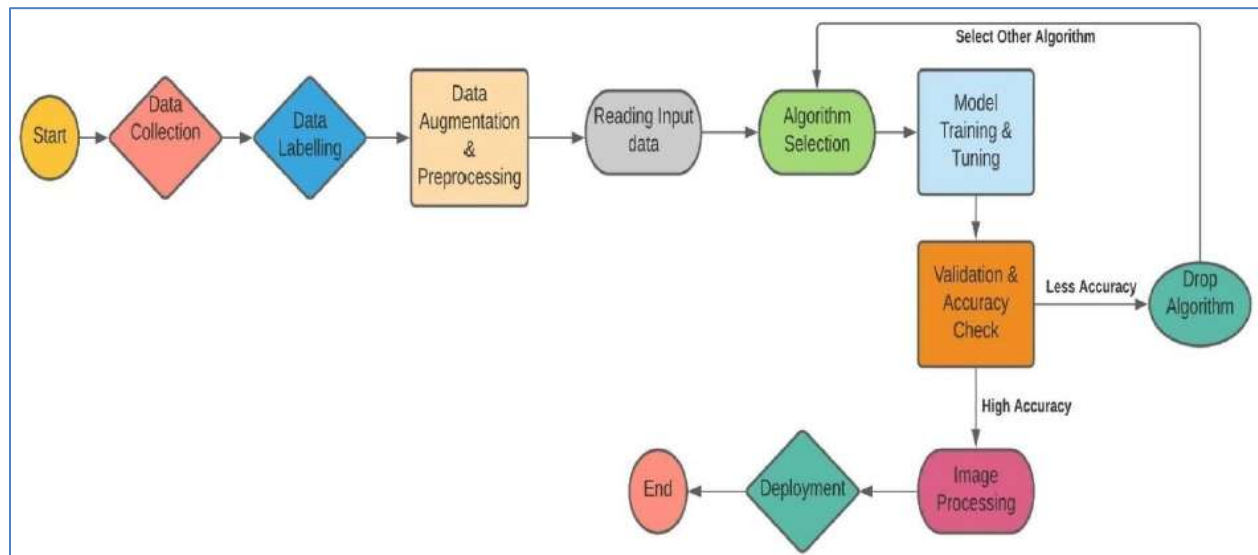
Architecture Explanation:-

1. Data Collection - It is the process of collecting images from multiple sources like through camera, Google's Open image dataset, Kaggle, Shutterstock.

2. Data Labelling - It is the process of annotating the objects present in the image so we can train our model accordingly.

3. Data Augmentation & Pre-processing - It is the process of applying some augmentation and pre-processing techniques like rotation, cropping, saturation and others which makes the images more generalized and provide more variations in images.

4. Model Training and Tuning – It is the process of training input images on different object detection algorithms and tuning the parameters of algorithm for getting better result.

5. Validation & Accuracy Check – In this process accuracy of the model obtained is checked and validated on validation images.

6. Image Processing – In this process after getting high accuracy on validation images, image processing is applied on images and videos for using it in different use cases.

7. Deployment – Deployment of the model means integration of model into production environment which will take input and provide us output that can be used in real-time scenarios.