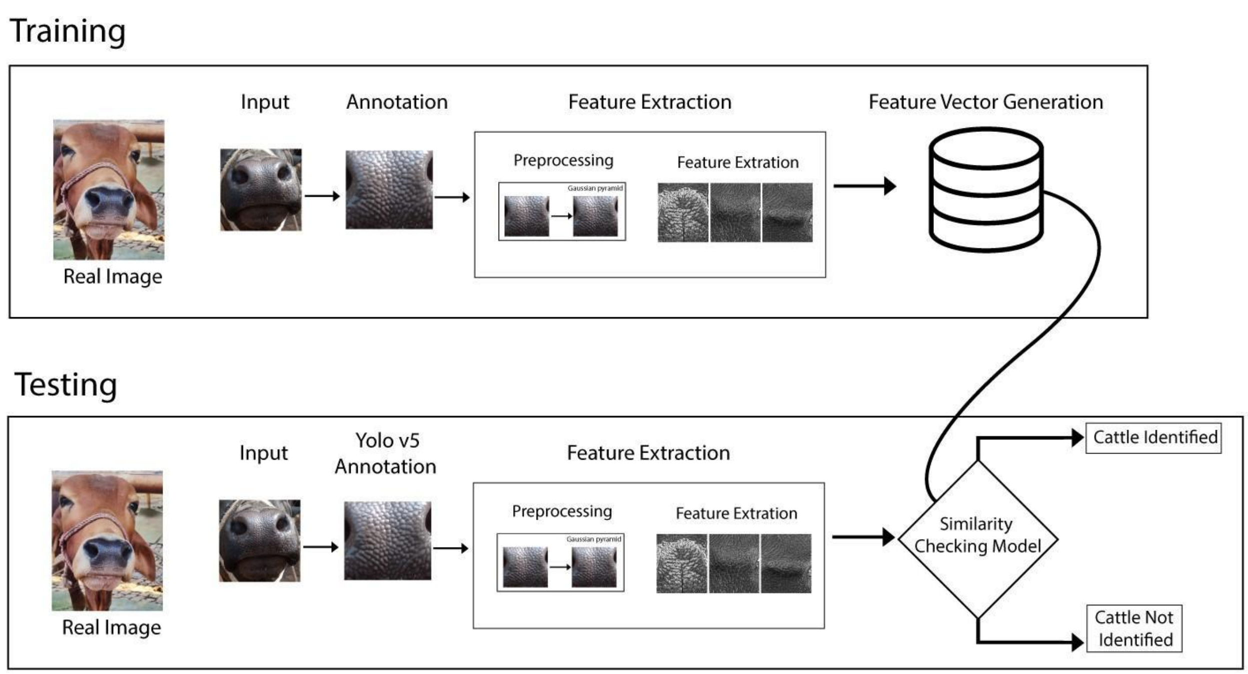
Project Title: Cattle identification using Deep learning.

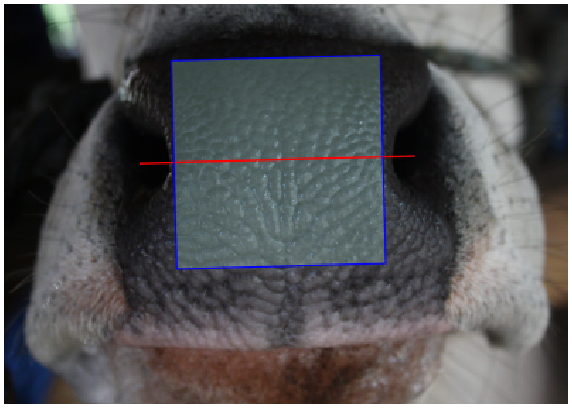
Project objective: Traditional non-biometric cattle identification procedures do not give sufficient reliability because to theft, fraud, and duplication. So, we a need reliable way to find the solation. The biometric-based technology uses computer vision and intelligent monitoring tools to gather the distinctive and stable biological traits of cattle, including iris patterns, face pictures, muzzle print images, retinal vascular patterns, and other visual features, and it offers affordable and effective techniques for identifying cattle.

Our Target Process: For Our project we are selecting cattle face pictures, muzzle print images.

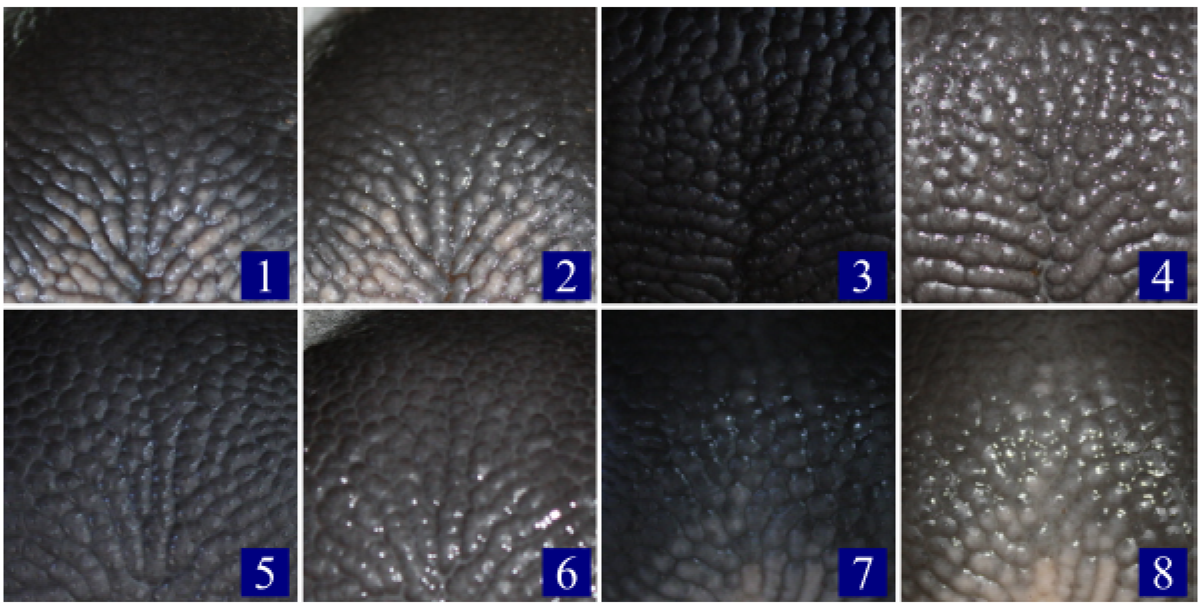
Workflow:



1. Data Collection Process:
   Date collecting is the most important part in our Cattle identification. We want to identify cattle by using cow muzzle. The images were manually standardized in terms of orientation and scale, using a consistent method. In each photo, the region of interest (ROI) was defined as a rectangular area centered on the minimum line between the nostrils. The ROI illustration is provided. The size of each ROI varied and was therefore resized to a standardized dimension of 200 x 200 pixels. To enhance the image contrast, an intensity transform motion function was applied.



It's worth noting that the photos were taken from different angles and under varying illumination conditions. An example of the resulting standardized data is shown below.

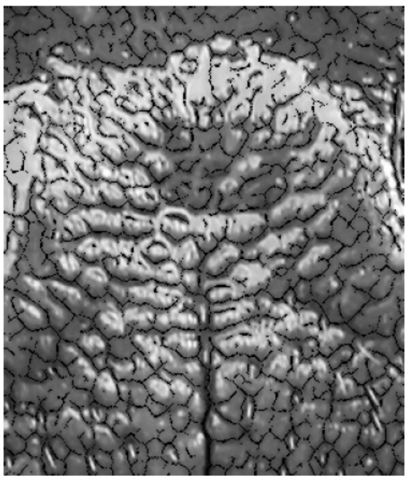
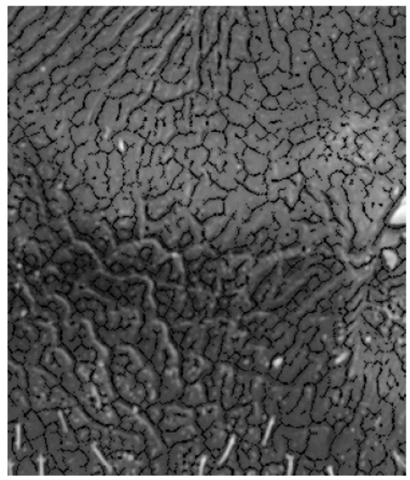
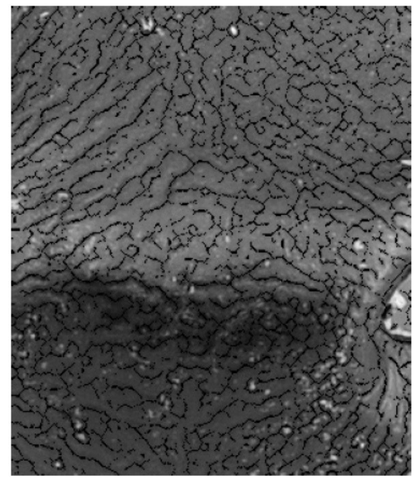


If we notice the image, we can see that every single point of the muzzle. It will help to identify every cow uniquely.

2. Annotation: Annotating an image is the process of adding labels or tags to it in order to give it context and make it easier to interpret. Using Label Studio, we annotators are manually labeling images of cows. which, depending on the complexity of the labeled data, becomes a difficult task. Making sure that work is consistently and accurately labeled takes a great deal of effort. We have correctly identified the necessary parts of the cow so that the image of the cow can be used correctly in our project later. First, we selected the correct and usable images and set the images to be annotated as needed. Then we selected the tools that will be correct and effective for us from among various annotation tools. After selecting the right image and the right tools, we have completed the next necessary steps to complete the image annotation, such as, after opening the correct tools for image annotation, we loaded the image of the cow and then identified

the different parts of the image of the cow. We have taken our work forward by paying special attention to whether the various parts of the cow's body have been correctly identified. When we correctly label the data, we save it and re-check that the data is correctly annotated, and the image quality is correct, and we take necessary action if any problems are detected.

3. Feature Extraction:

- Preprocessing: In image processing, the Gaussian pyramid is a popular method for image blending, image compression, and image scaling. Each level of the pyramid represents a lower-resolution version of the original image in this multi-resolution representation of an image. The Gaussian pyramid's main objective is to create a series of images with half the width and height of the image before it. Starting with a Gaussian filter, a low-pass filter that removes high-frequency components from the image, the original image is smoothed. The original image is down sampled by a factor of 2 in both the x and y directions and forms the base of the pyramid. Remove high-frequency components and keep only the low-frequency components and apply a Gaussian filter to the down sampled image. The smoothed image should be down sampled in both the x and y directions by a factor of 2. The pyramid's next level is developed as a consequence. To remove high-frequency components from the down sampled image, apply the Gaussian filter. To generate as many layers of the pyramid as necessary, the previous processes are repeated. The Gaussian pyramid is used in the processing of images for a variety of reasons, including image blending, image compression, and image scaling. In computer vision applications, it is a useful method of describing an image at various scales.
- Feature Extraction:

I. SIFT: Scale-Invariant Feature Transform (SIFT) is a computer vision technique for identifying and matching image features. The SIFT method finds distinguishing key points or features within an image that are unaffected by adjustments to scale, orientation, and illumination. Scale-Invariant Feature Transform, or SIFT, is a technique for identifying key points or other areas of interest in images that are unaffected by changes in scale, rotation, and translation. The local feature descriptor, which is a histogram of gradient orientations produced in the surrounding image region, is then used to describe the key points. For picture matching, object detection, and 3D reconstruction, the SIFT algorithm is frequently used. Overall, the SIFT algorithm has been widely used and has had a significant impact on computer vision research and applications.

II. SURF: SURF (Speeded Up Robust Features) is an algorithm for feature matching and detection in image processing. It was developed to overcome several issues with previous feature detection algorithms, such as SIFT, which can be computationally expensive. the SURF algorithm is known for its robustness to changes in scale, rotation, and lighting, making it a popular choice for many computer vision applications. However, it should be noted that newer algorithms like ORB and Deep Learning-based methods have surpassed SURF in terms of speed and accuracy in some scenarios. The SURF algorithm first finds interesting areas in a picture using a scale-space approach, which gradually smoothest and down samples the image to find characteristics at different scales. The local texture and orientation of the image surrounding each of these interest points are then described using a set of descriptors.

4. Feature Vector Generation: Converting an image's important characteristics or patterns into a vector of numbers is a process known as "image feature vector generation." The procedure entails evaluating the image for distinguishing elements such as edges, forms, and textures that are important in identifying the image's content. Many applications, including image classification, object identification, and image retrieval, can make use of the feature vectors produced from a picture. For instance, feature vectors created from a picture are used to train machine learning models that categorize photos into various groups based on their visual content. Image Feature Vector Generation is an important stage in many computer vision applications that rely on picture analysis and interpretation. The procedure entails identifying significant characteristics from pictures and encoding them as vectors that can then be analyzed and processed further.

After that We are storing cow images in vector from a database. Then our training procedure complete.

5. YOLO v5: Deep neural networks are used by the object detection technique known as YOLOv5 (You Only Look Once version 5) to find objects in images. To estimate the bounding boxes and class probabilities for each cell, the algorithm divides the input image into a grid of cells. The algorithm resizes an input image to a predetermined size. The model uses a series of anchor boxes pre-defined bounding boxes of various forms and sizes to predict the locations and sizes of objects. A convolutional neural network (CNN) backbone processes the incoming image while extracting features from it. For any objects that are present inside a cell, each cell must predict the bounding boxes and class probabilities for those objects. The method predicts the bounding boxes of the items that are present in each grid cell. Each bounding box has four values: (x, y) which represents for the coordinates of the box's center, and (w, h) that represents the box's width and height. The method also forecasts the likelihood that each object will belong to a specific class. The algorithm also predicts the probability that each object will belong to a specific class. A SoftMax function is used to predict the class probabilities. Non-maximum suppression is used by the algorithm to get the removal of bounding boxes that are redundant and have a lot of overlap. A set of bounding boxes and the related class probabilities are the algorithm's final output.

6. Similarity checking Process: Testing is similar as training processing. Just deference is YOLO V5 replace the annotation process. Because YOLO v5 automatically annotated image. Our last process, checking the cow image in vector form comparing our database image. So, we can identify cattle within a short time.

We are presently in the development process of all our suggested models. Then there are two more phases: testing and implementation.