

AGE AND GENDER PREDICTION USING DEEP LEARNING



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INTRODUCTION

- To replicate the human capability at recognizing faces and complex patterns.
- Application which predicts an age bracket as well as a gender between a male and female from a single image received as input.
- Created with a simple convolutional neural net Caffe architecture for gender classification and age estimation that can be used on 'real-world' images.
- The product can be helpful in various ways:



Criminal records



Surveillance



Finding lost kids



Science

PRODUCT FEATURES

- Age classification:** Extracting age related attributes from facial images has received increasing attention in recent years. The focus here will be on age group classification rather than precise age estimation (i.e., age regression).
- Gender Classification:** The problem of predicting gender from images regards to foundational difference between the facial attributes of the two different genders
- CNN for age and gender estimation:** Data-sets for age and gender estimation from real-world social images are the relatively limited in size and presently no match in size with the much larger image classification data-sets (e.g. the Imagenet dataset). Overfitting is common problem when machine learning based methods are used on such small image collections. To avoid those Caffe model has been used.

HARDWARE SOFTWARE

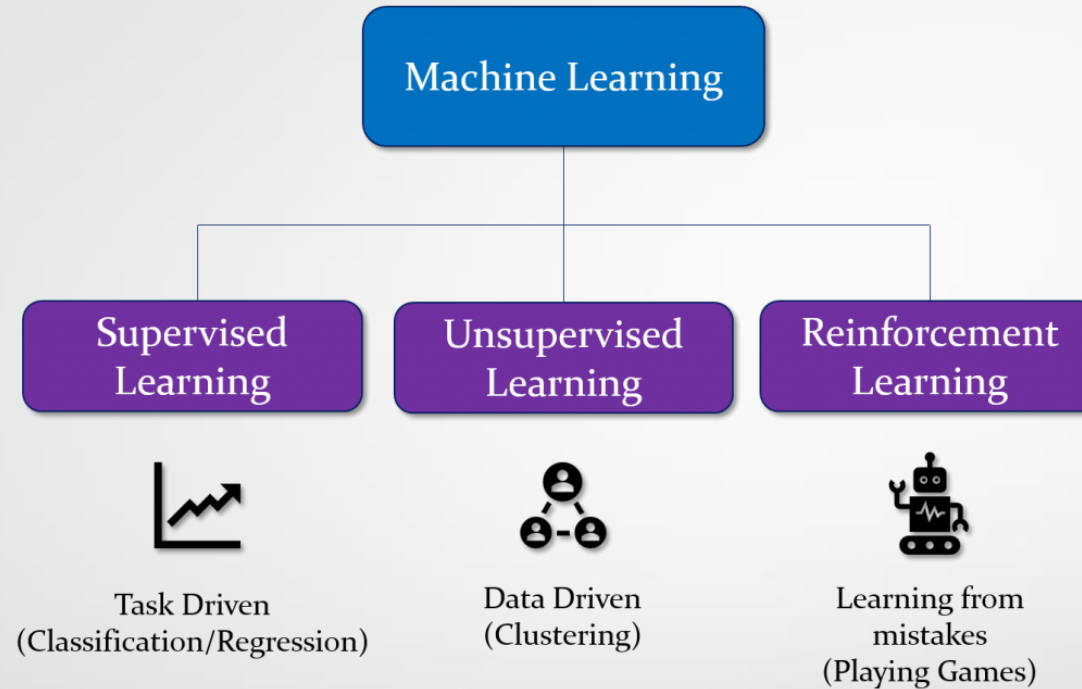
Hardware Requirements :

- Optionally, Internet access is helpful
- Android Platform/Internet Browser
- Well functioning mobile/computer camera

Software Requirements

- Operating system: Android, Windows , Linux , Mac OS
- Storage: Between 850 MB and 1.2 GB, depending on the language version
- Memory required - 16 gb RAM
- Python3.0+

MACHINE LEARNING

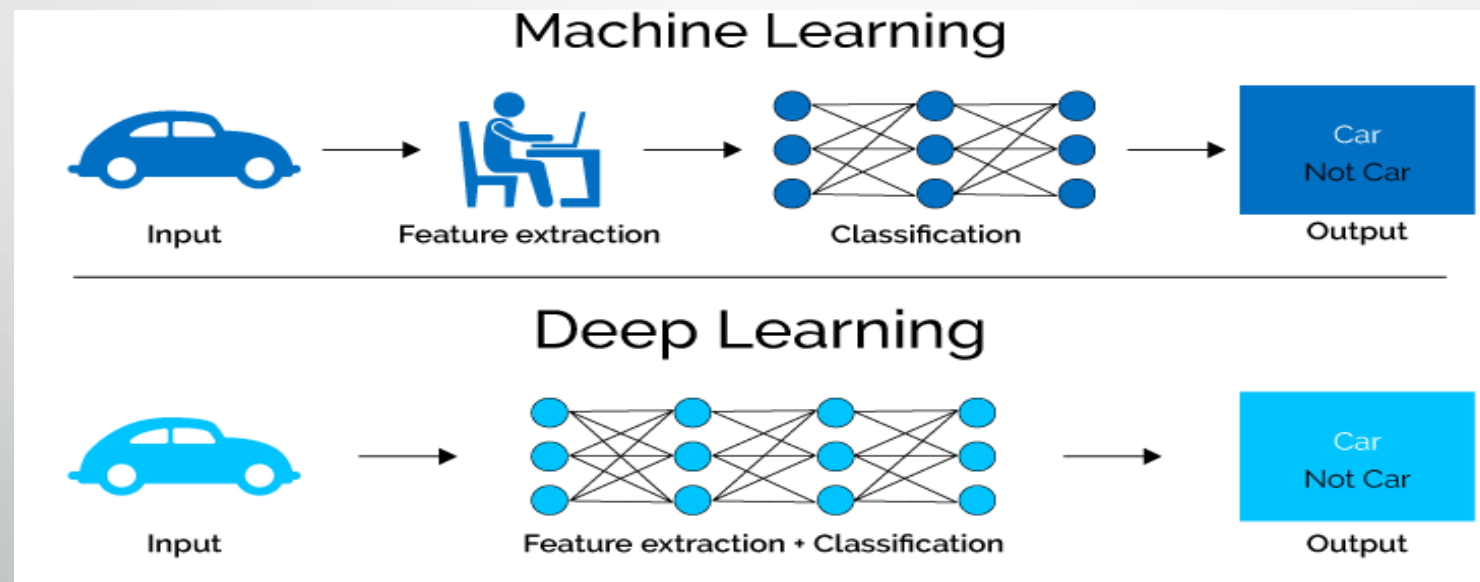


Machine learning is also associated with a few other artificial intelligence subfields:-

- Natural Language Processing
- Neural Network
- Deep Learning

DEEP LEARNING

The foremost differentiate between conventional machine learning and deep learning algorithms is inside the feature engineering. In conventional machine learning algorithms, we have to be hand-craft the features. By differentiate, in deep learning algorithms feature engineering is done automatically by the algorithm.

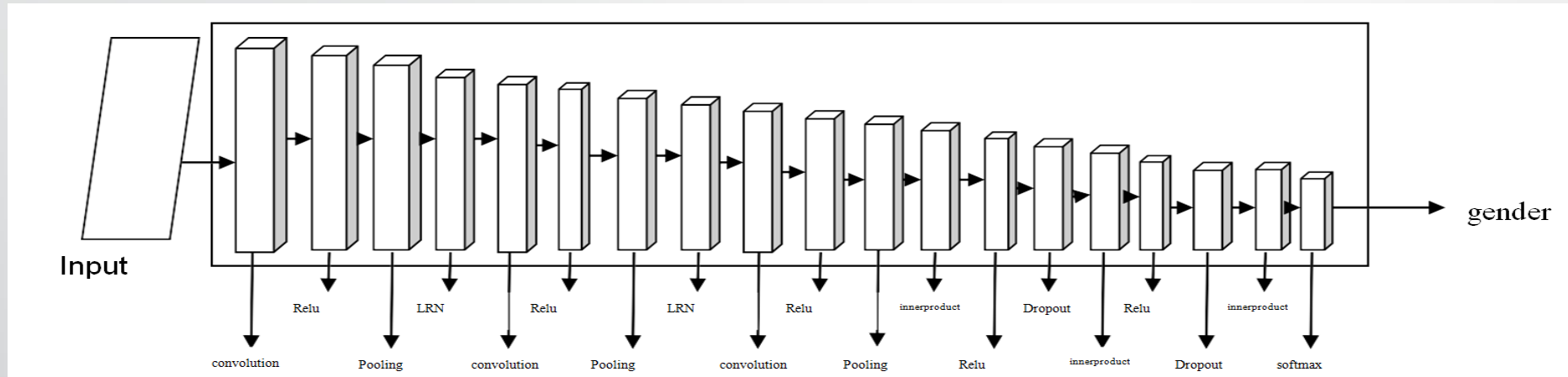


Caffe (Convolutional Architecture for Fast Feature Embedding)

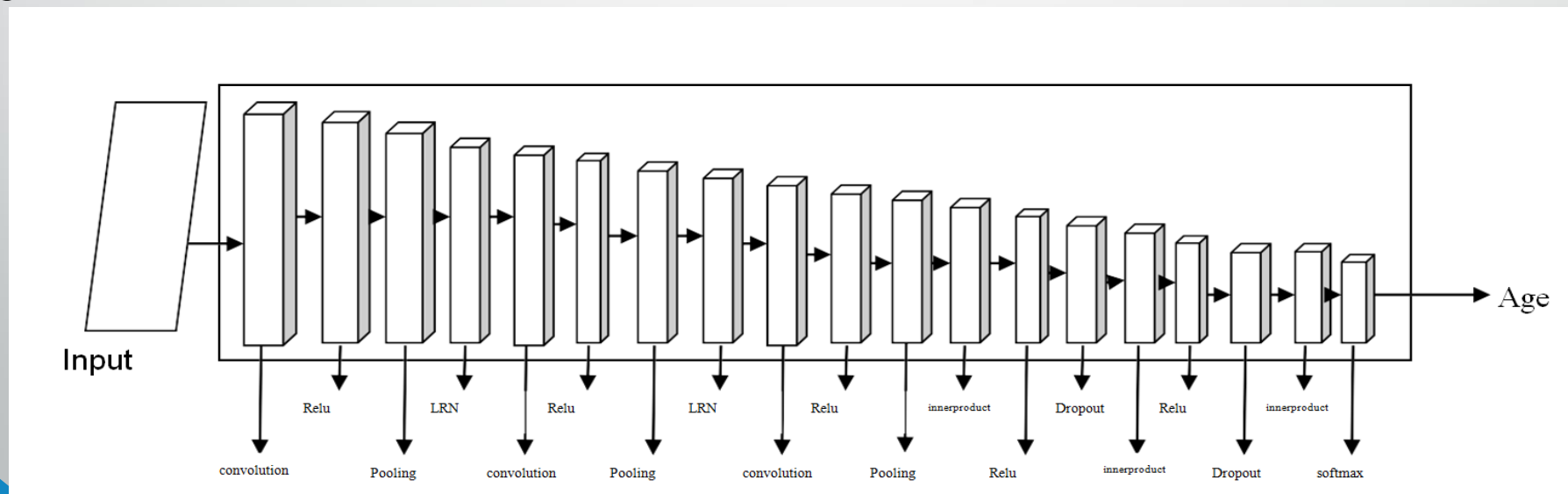
- Caffe created by the Berkeley Vision and Learning Center (BVLC) .Being especially motivated by large scale visual recognition, where a particular sort of deep architecture has accomplished a commanding lead on the state-of-the-art. These Convolutional Neural Networks, or CNNs, are arranged by means of back-propagation through layers of convolutional filters and other operations such as rectification and pooling.
- Advantages of Caffe model over other models-
 - Modularity
 - Separation of representation and implementation
 - Python binding
 - Pre-trained reference models

CNN ARCHITECTURE

For gender model



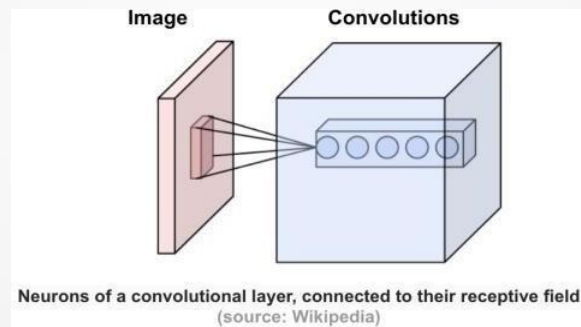
For age model



LAYERS FUNCTIONALITIES

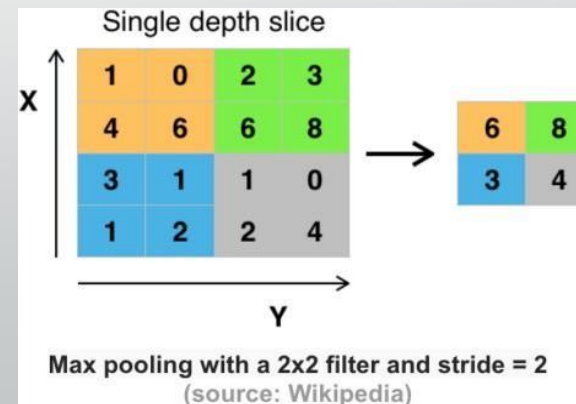
1. Convolution layer

- computing dot products between the entries of the filter and the input picture



2. Pooling layer

- The objective of the pooling layer is to continuously decrease the spatial size of the representation to reduce the amount of parameters and computation within the network, and subsequently to also control overfitting.



3. ReLU / Rectified-Linear and Leaky-ReLU Layer

ReLU work could be a piecewise linear function that yields the input straightforwardly in case is positive i.e. > 0 , otherwise, it'll yield zero.

4. Local Response Normalization (LRN) Layer

"The local response normalization layer performs a kind of "lateral inhibition" by normalizing over local input regions.

5. Inner Product / Fully Connected Layer

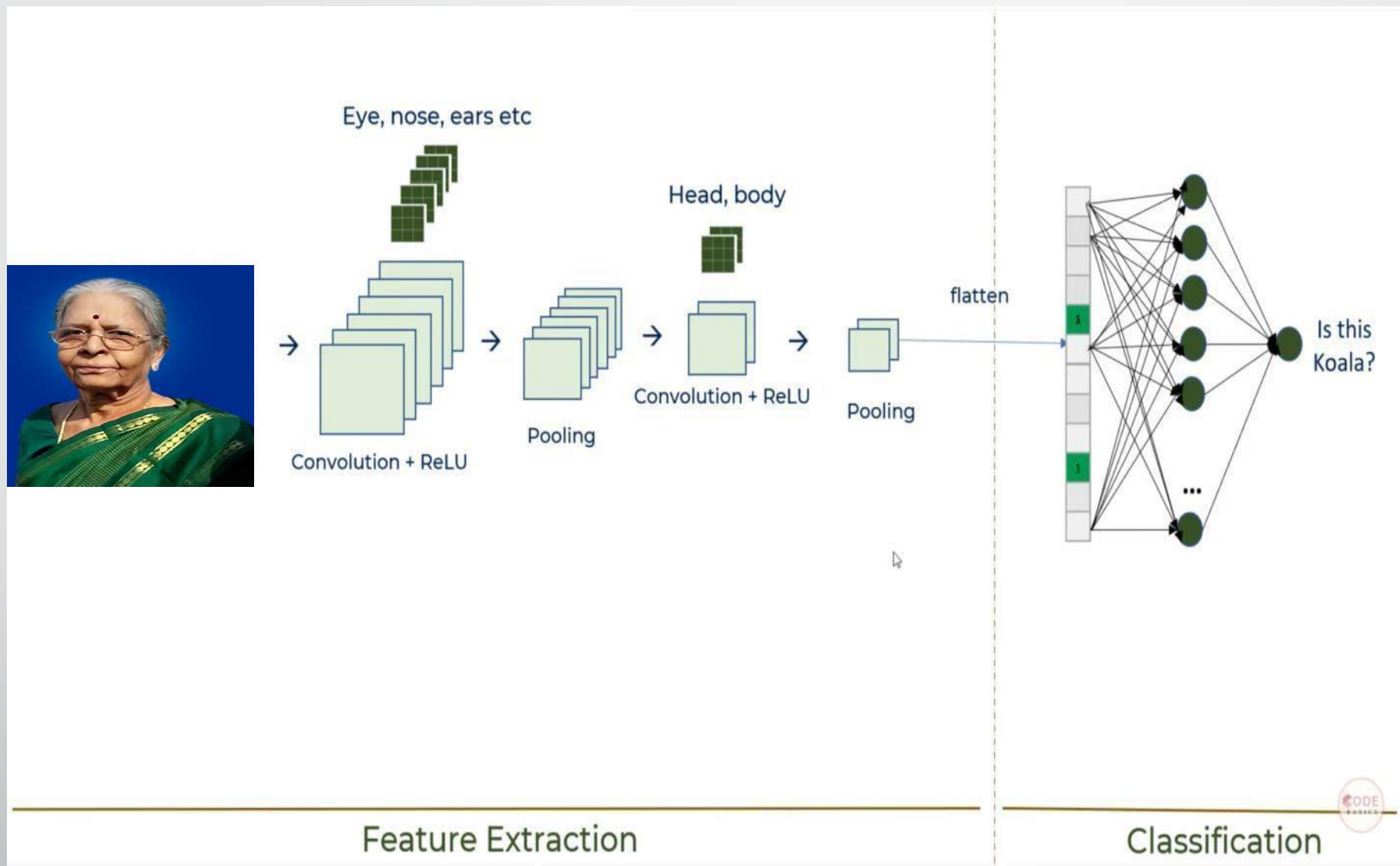
The InnerProduct layer (also usually referred to as the fully connected layer) treats the input as a simple vector and produces an output in the form of a single vector (with the blob's height and width set to 1).

6. Dropout Layer

Dropout is a technique used to prevent a model from overfitting. Dropout works by randomly setting the outgoing edges of hidden units (neurons that make up hidden layers) to 0 at each update of the training phase

7. Softmax Layer

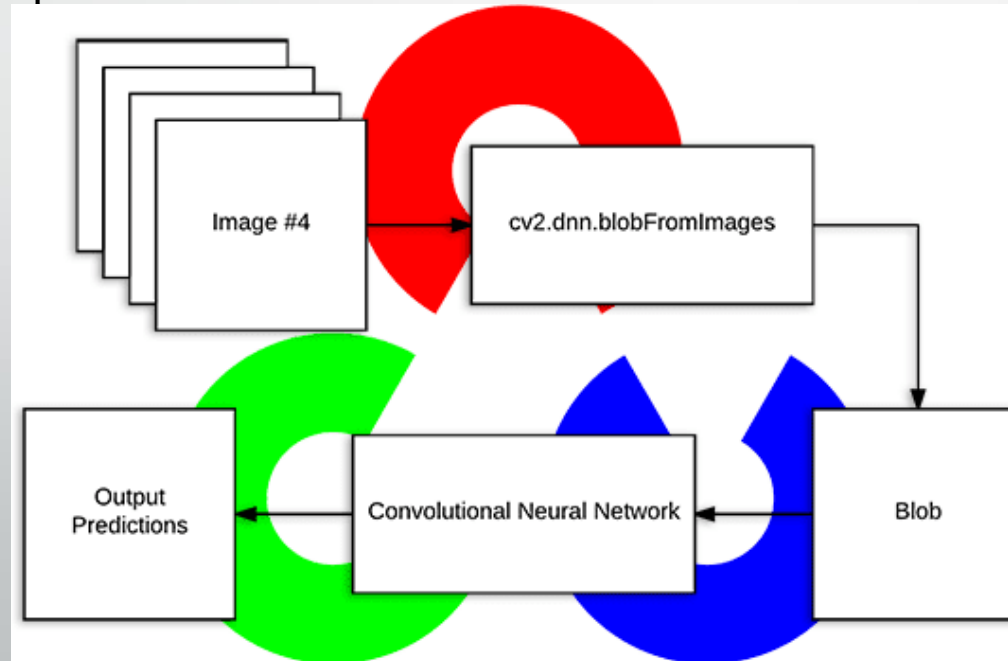
Softmax assigns decimal probabilities to each class in a multi-class problem. Those decimal probabilities must add up to 1.0. This additional constraint helps training converge more quickly than it otherwise would. Softmax is implemented through a **neural network layer** just before the output layer.



HOW CAFFE WORKS

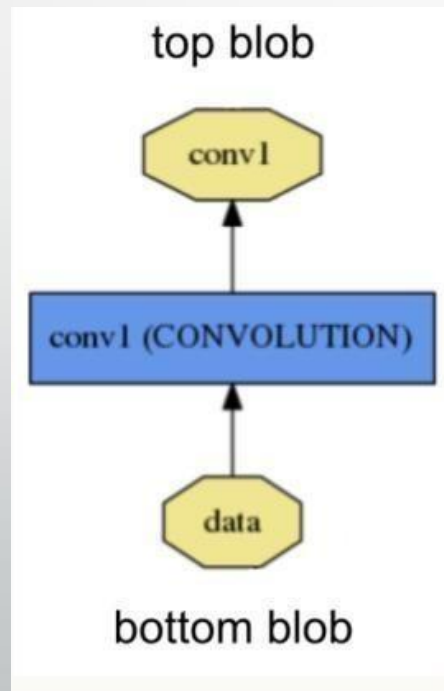
Blob

- A Blob is a wrapper over the genuine data being processed and passed along by Caffe.
- The blob is the standard cluster of array and bound together memory interface for the framework.
- The subtle elements of blob portray how data is put away and communicated in and over layers and nets.
- Blobs give a unified memory interface holding data; e.g., bunches of pictures, model parameters, and derivatives for optimization.

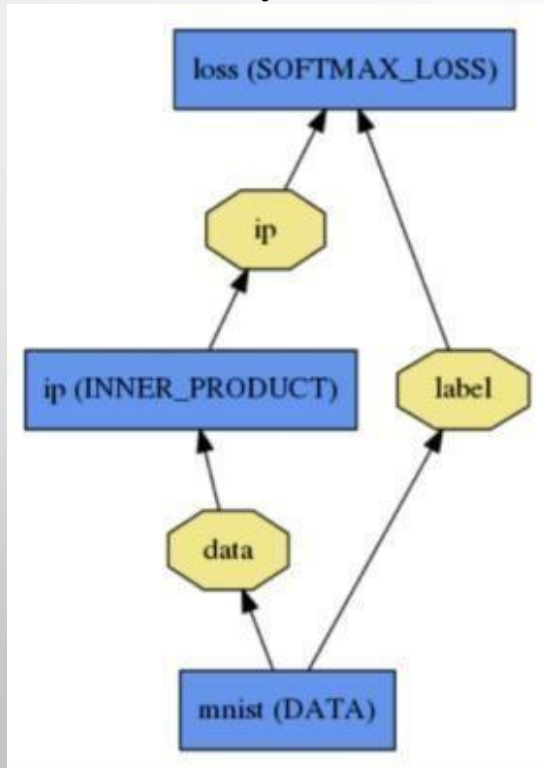


Layer

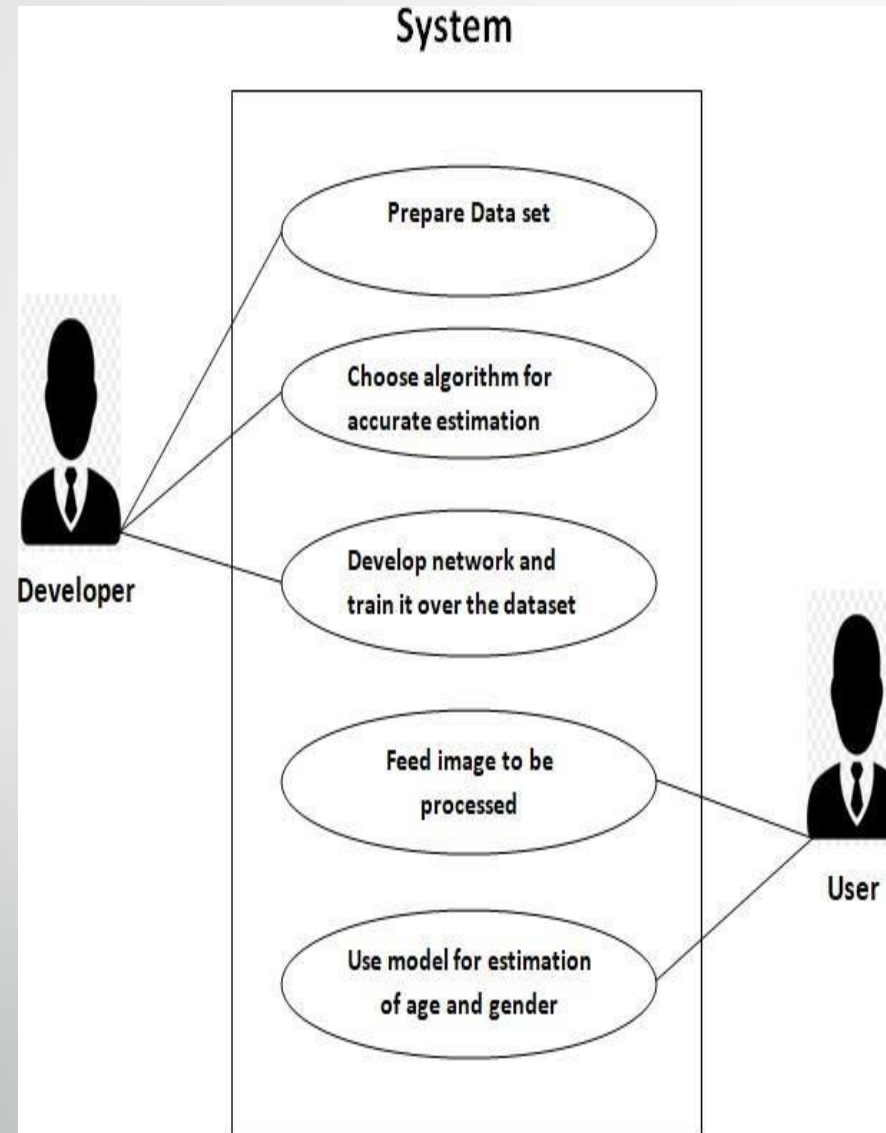
- The layer comes taking after as the establishment of both model and computation.
- A layer takes input through bottom connections and makes output through top connections.
- Each layer type defines three critical computations: setup, forward, and backward.
- **Setup**: initialize the layer and its connections once at model initialization.
- **Forward**: given input from bottom compute the output and send to the top.
- **Backward**: given the gradient w.r.t. the top output compute the gradient w.r.t. to the input and send to the bottom. A layer with parameters computes the gradient w.r.t. to its parameters and stores it internally.



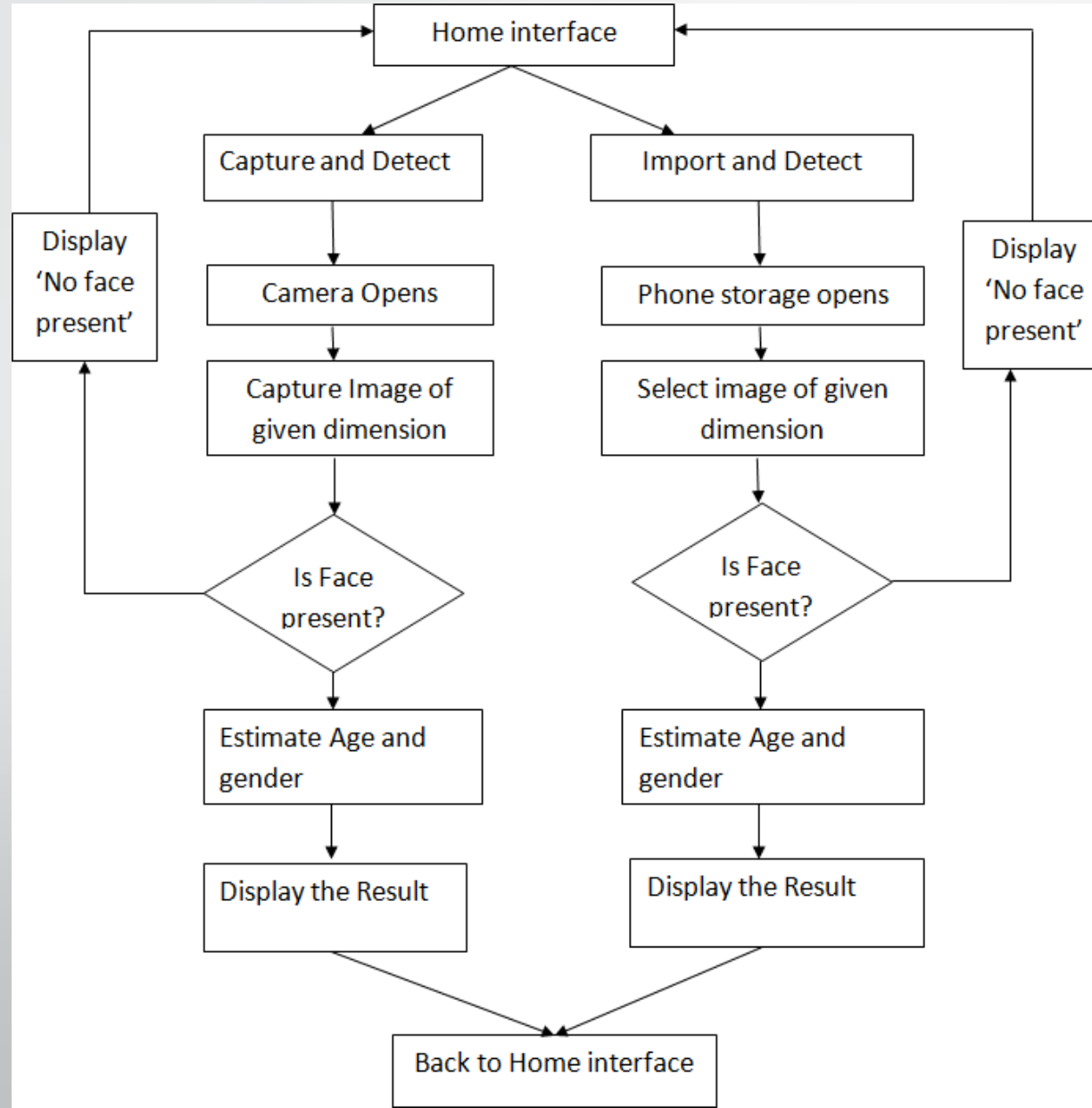
- **Net**
- The net takes after as the collection and connection of layers.
- The net mutually characterizes a function and its gradient by composition and auto- differentiation. The composition of each layer's output computes the function to do a given task, and the composition of each layer's backward computes the gradient from the loss
- to memorize the task. Caffe models are end-to-end machine learning engines.
- The net is characterized as a set of layers and their affiliations in a plaintext modeling



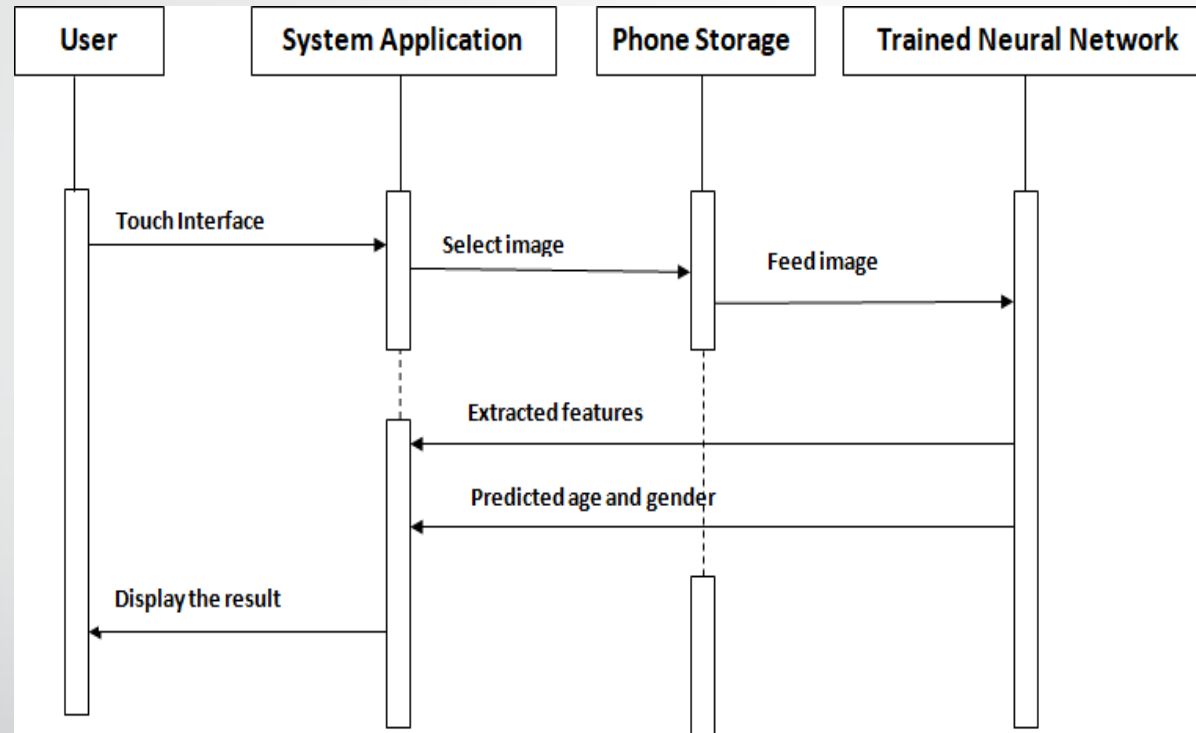
USE CASE DIAGRAM



FLOW DIAGRAM

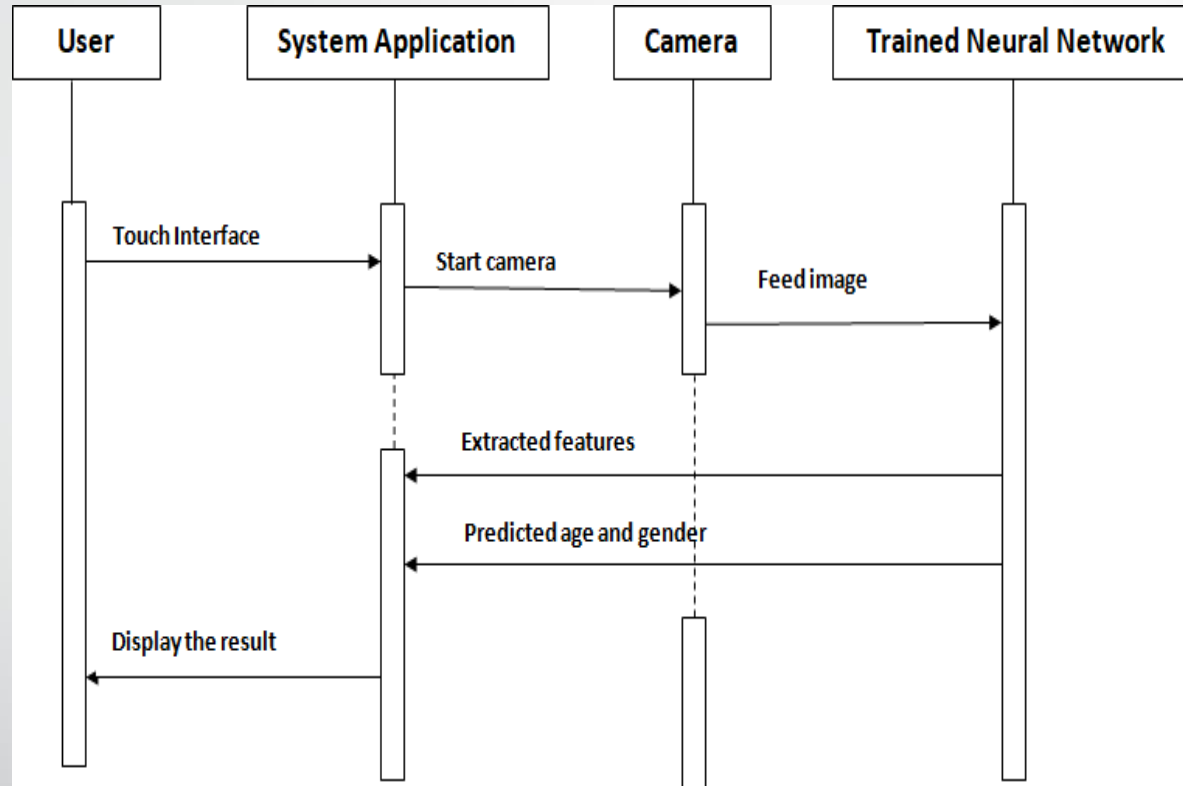


SEQUENCE DIAGRAM



IMPORT AND DETECT

SEQUENCE DIAGRAM



CAPTURE AND DETECT

Test cases

CAPTURE AND DETECT

This feature enables user to open the camera of the user's system and asks the user to take a picture which is then forwarded to processing and the results are provided.

Response sequence

- Click the button " Capture and detect "
- User will be redirected to camera screen.
- User should now capture a perfect image.
- Detect faces, if not present, display "No face detected".
- If faces are present, the result containing the estimated age and gender of the persons will be displayed.

Functional Requirement

- If image is not of given dimensions then, error message is generated. It asks the user to choose appropriate photo.
- If photo is blurred, error message is generated- 'Picture is blurry'

IMPORT AND DETECT

This feature enables users to import picture from their pre existing images stored in phone memory and allows the app to process the picture and provide the result.

Response sequence

- Click Button “Import and Detect”.
- User is redirected to system storage.
- User need to select image accordingly.
- Detect faces, if not present display ‘no faces detected’.
- If faces are present, estimate age and gender.
- Display the result.

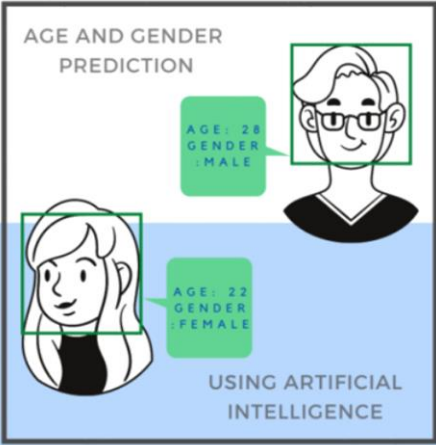
Functional Requirement

- If image is not of given then, error message is generated. It asks the user to choose appropriate photo.
- If photo is blurred, error message is generated-‘Picture is blurry’.

LAYOUT

HOME PAGE

AGE AND GENDER
PREDICTION




AGE: 22
GENDER: FEMALE

AGE: 28
GENDER: MALE

USING ARTIFICIAL
INTELLIGENCE

AGE AND GENDER DETECTOR!

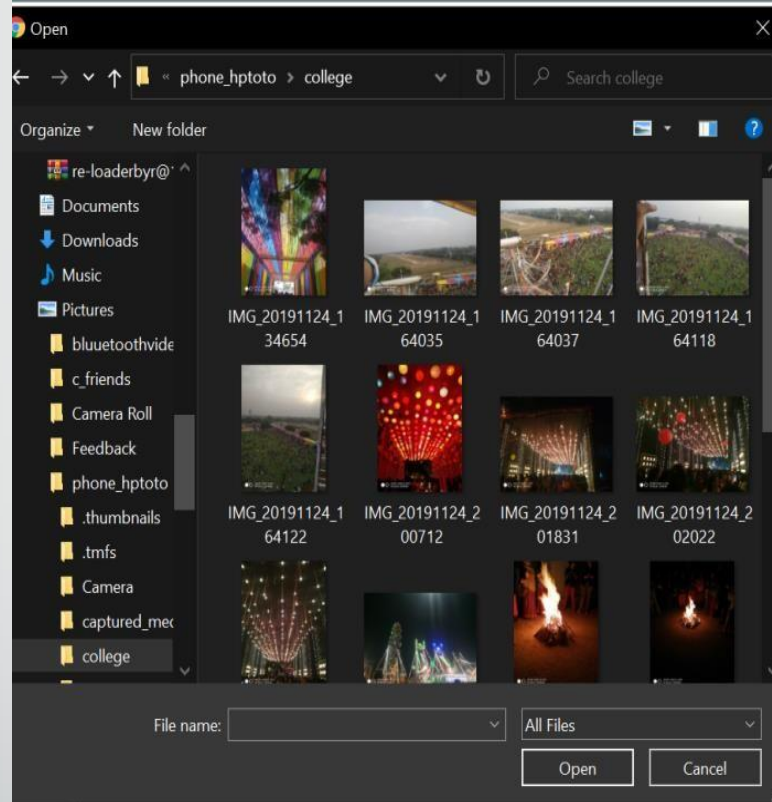
Select your preference

 Upload (0)

CAPTURE PHOTO

SUBMIT

SELECT AND DETECT



AGE AND GENDER DETECTOR!

Select your preference

Upload (0)

CAPTURE PHOTO

SUBMIT

CAPTURE AND DETECT



REFERENCES

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- <https://www.hindawi.com/journals/tswj/2020/1289408/>
- https://www.researchgate.net/publication/321479959_Facial_detecti_on_using_deep_learning55
- Yangqing Jia (2014) Caffe: Convolutional Architecturefor Fat Feature Embedding



THANK YOU