1 to 8 aathi introduction

9 to 19 chandru Subsystems, math modelling,

20 to 26 aathi constraints, objectives

27 to 31 chandru Conceptual design, block diag, Implementaion (Very very important)

31 to 37 aathi components

My friend aathith, presented a brief information to the problem statement and the proposed solution. The major sub systems involved in our solutions include

1. System to take photo
2. System that identifies the students in the photo

The system that takes photo, it is evident from the name itself what action is it going to perform. It contains the components such as camera, a system to signal the camera and a system to transfer the taken photo. we will explain what is the need for explicitly signaling the camera there is a need for it.

This is simple.

Coming on to the next major sub system, this is the part that is going to do the facial recognition. This contains a lot of sub system as it is going to do the important part of identifying somebody from the photo. The flow of operation is follows receive the photo, identify the faces in the photo, for each face identified give the unique descriptor of that face (think unique descriptor as a unique number generated for unique face that the machine can understand) and at last after knowing the descriptor I can easily mark the attendance.

I am going to explain more about a few of the components of the systems that I mentioned before.

“The system that outputs a descriptor for all the faces in the photo”. After we find “m” faces in photo we are going to iterate through each individual face. Now each face is fed into the facial recognition algorithm that gives us the unique descriptor for each face so at last we will get “m” descriptors for a photo we will store that.

“The system that iterates “m” descriptors and marks the attendance”. We are having “m” descriptors that the machine can understand, now how to mark the attendance. Well at first think we are having a data base that contains the student’s register number and the descriptor of the student’s face stored. Then our work becomes easy just, iterate through the “m” descriptors and check whether they are in the database of student, if it is available mark the attendance against that student.

Next up we will be seeing the mathematical modelling of some of the systems explained. Seeing this slide you can understand why are we explicitly signaling the camera, actually we are triggering the camera every 5 min to take a photo.

The facial recognition algorithm that takes the input as a image containing one face and then gives the descriptor of that face. I think you already got a good concept of what is the function of descriptor. To be more precise the algorithm actually outputs a vector of fixed size that contains floating numbers. The values of the number changes for different faces.

When I was explaining you about the “system that takes m descriptor and marks the attendance” I told you about data base and how we are checking the descriptors are equal to mark the attendance.

But as I told the algorithm here does not return a number but a vector or simply an array of values, to compare vectors for the similarity we need to use cosine similarity. Essentially what we are doing is telling how much similar these 2 faces are, one that we take in the class, one that was previously taken.

Coming on to the conceptual design, the answers to the questions were as follows

We needed a system that marks the attendance for the student present in the class, intelligently by assessing how much time the student was present.

From our proposed solution we emphasized the use of facial recognition and camera for our solution.

As the facial recognition overcomes the problems faced in the previous system explained

Now to visually represent the systems that we talked about in a concise diagram.

Coming on to our implementation we have finalized the use of these 2 algorithms, for facial detection using DLIB HOG (Histogram of oriented gradients) and for facial recognition a convolutional neural network that has been pre trained for giving out descriptors of size 128.

We are using raspberry pi for implementing all of the sub systems explained.

Content to be put in report

Sub systems

Our proposed solution should have a camera and it should a facial recognition algorithm. Keeping in mind these 2 points, we designed the major sub systems in our solution. To control and interface the camera we needed a system and to run the facial recognition we needed another system. So, 2 major sub systems were designed to addressing these 2 specifications.

The major sub systems involved in our solutions include

1. System to take photo
2. System that identifies the students in the photo

We wanted these 2 systems to be separate as when we design them keeping in mind, they are separate and interconnected by another system.

1. System that takes the photo:

The system that takes photo, it is evident from the name itself what action is it going to perform. It contains the components such as

1. camera,
2. a system to signal the camera
3. a system to transfer the taken photo.

We kept another system to explicitly signal the camera and there is a need for it. As one of our motivation is that we wanted to give attendance to those students who are present in the class for its full duration. To tackle this problem, we have simply divided the whole class duration into separate chunks of 5-minute duration. So, every 5 minutes the camera is signaled to take photo and the photo taken is then sent to the next major sub system for facial recognition.

1. Camera
   1. A camera is an optical instrument used to record images. At their most basic, cameras are sealed boxes (the camera body) with a small hole (the aperture) that allow light in to capture an image on a light-sensitive surface (usually photographic film or a digital sensor)
2. A system to signal the camera
3. A system to transfer the taken photo

System that marks the attendance:

Coming on to the next major sub system, this is the part that is going to do the facial recognition. This contains a lot of sub system as it is going to do the important part of identifying somebody from the photo. The flow of operation is as follows

1. receive the photo
2. identify the faces in the photo,
3. for each face identified give the unique descriptor of that face
4. using the descriptor marking the attendance

A short explanation about unique descriptor is that it can be considered as a unique number generated for unique face that the machine can understand. Ideally the facial recognition algorithm should output the same number if you input the same face even if is the same person in a different outfit or in a different makeup, i.e. even when the physical characteristics changes. To be more technical we can divide this sub system into a number of components as follows

1. System that receives the photo
2. System that runs the face detection algorithm that outputs “m” detected faces
3. System that outputs a descriptor for “m” faces
4. System that iterates through “m” descriptor and marks the attendance

Now these components are divided in the same way as the flow is described above.