# Slide 1

Greetings welcome to our zeroth review presentation of our project. Our project is titled as Marks2CSV v2. Some of you will be familiar with the title. Yes, we have successfully copied from our seniors. Wait a second, that’s not what I meant. We are continuing from where they have left of.

I am Jacob Philip, together with me in the team are Don, Aneeta, Pranav and we are guided by Jabin mam.

# Slide 2

To start off, I want to give you a brief on the outline of this ppt. We would be taking on an introduction where we would give an idea of what Marks2CSV is. Then we would be quickly going through where they have left of and followed by the challenges we have taken forward and then proceed to a quick technical overview of what we are planning. Following that we want to give you all a picture of our status is and how it is going forward. The entire ppt is going to take about 10 mins of your time. Hope you all would be patient until then.

# Slide 3

Marks2CSV is an effort of our former batch which consisted of ……………. under the mentorship of Dr. Deepa V. The basic idea was to simplify the post evaluation documentation which is basically tabulating marks as per CO’s. So, in the previous version the team has achieved significant results which motivated us to continue the same so as to give back our wonderful teachers something on our behalf.

# Slide 4

So, talking about where our previous batch left of, they were able to convert handwritten marks ranging from 0 to 7 into a csv file, as the data is converted to csv format it allows users to read and edit the data with ease, the remarkable thing about their model was the fact that it was able to produce results quickly and accurately, it was able to analyse 5 papers in a timespan of just 13 seconds and provided an accuracy of 99%.

# Slide 5

Now let’s move on to the objectives that we are aiming to achieve with this project, our iteration of the Marks2CSV project will be having a model that is able to recognize digits from 0 - 14, and one of the major features of our model is that it will be able to recognize fractional marks too, our model will feature a validation system to cross check the marks while providing real time outputs, this will allow our program to predict the characters much more clearly and accurately. Our model will be able to perform such complex tasks while providing efficient data processing and a seamless method to interact with the system.

# Slide 6

Since we are aware of the objective that we are going to achieve, let’s see how we are going to achieve that.

Firstly, our system will capture the image of the answer sheet i.e., a frame would be recorded as an image when the user clicks the capture button.

The next process is to preprocess the image so that it would be fit for further recognition by the deep learning model. In this step, the portion of the answer script is cropped out of the captured image and will give a perspective warp to it, so that we will get the answer sheet in proportion of the real answer sheet. We would then make the image black and white and then convert the bright parts to pure white and dark parts to pure black to make the image suitable for further processes.

After preprocessing the captured image, the system would then extract the table that contains the written marks. The python libraries – open cv and image2table are used for this process. These libraries provide a good result in finding out the co-ordinates of each cell in the table. With these coordinates, the system will be able to segment the table into images of each cell.

Each of this extracted image of cells are then fed to the convolutional neural network model for detecting the numbers. The details of the model architecture will be explained in the later slide. After detecting each cell, the mark will be stored into a data frame refereeing the relevant question.

After processing the whole table, the detected marks would be displayed, where the user will be able to make quick corrections, if any and proceed to capturing next image or export the detected tables as a csv in the required format.

# Slide 7

Now let’s dive deep into the structure of the model that is going to detect the marks in each cell.

The model receives an image of the cell that may or may not contain a mark. If it contains a written number, it can be either single digit or multi digit or even contains the weird symbols called the half mark along with the digit as shown here.

Images with a single digit can be easily identified by an ordinary CNN model. But in this case, this system has another approach. The image is fed to a CNN model that segments the group of digits from the original image into individual digits as shown. Then these individual digits are given to another CNN model which is trained to detect digits from 0 to 9 and halves.

These detected individual digits are then added to get the final mark of one single cell out of the whole table.

# Slide 8

Even if the system got best accuracy of detecting the marks, there will surely be some odd cases where the system would struggle to provide with a correct result.

To address those scenarios, it is designed in such a way that, after each scan, a table like this would be displayed on the screen containing the results of detection. The table would be in the same format as in the question paper and it would also show the detected marks in different colours making it easier for the users to identify quickly and conveniently.

Further, it would specifically show the cells that is difficult for the system to recognise, where the user could make a quick correction.

# Slide 9

Since you got an idea of our whole plan let me explain what’s all been done so far. After team formation and project selection, we’ve met up with our seniors, discussed about their works and ideas. We collected their inputs, got an idea of how their model works. We planned out a structure of how the project to be done and divided the work among us.

Then we came up with a plan to create a CNN model that could identify digits from 0 to 9, including fractional marks. Our model trained on available data is overfitted due to insufficient dataset.

We have enough dataset for single digits, i.e., 0 to 9, but not enough fractional marks. Thus, we are in the process of collecting more data for half marks. Currently we have around 200 instances for each half marks and we plan to collect around 1000 instances for each. To achieve this, we’ve circulated tables similar to the tables in the answer sheets to be filled up.

# Slide 10

Next on slide is our project timeline which points out our main milestones that have been achieved and yet to be achieved. So far, we formed our team and held a meeting to discuss the possibilities of this project. We often met up and shared what's been done. We also had a discussion with our seniors about their works and ideas. Then we chose Jabin ma’am as our guide, and we submitted the abstract on 29th January. After various experimentations we finalized on our CNN model that could identify digits by third week of February.

Now for our future milestones that are yet to be achieved, we expect to complete data collection of all digits from 0 to 14 including fractions by 11th of March. Then scale up our model to identify digits up to 14 by 20th of March and finalize our model with no odd cases or errors by 29th of March. We hope to implement our model into a usable form by April 12th and conduct a test on our implemented system by April 22nd. We wish to do the final release of our system by 26th of April.

# Slide 11

This slide contains the key references that have provided a foundation for our project.

First, a paper by Goodfellow and team which provides an insight on different methods to handle

multi-digits.

Then we have a work by Lecun and team which gave us insights on preprocessing the input and OCR techniques to recognize the digits.

In our third reference by Dixit and team, we got an idea of pattern recognition.

The fourth reference by Anagnostopoulos and others discusses a license plate recognition algorithm which gives an input to implement our project to a more usable form.

Let's take a moment to acknowledge the pivotal research and contributions that have informed our work. This slide lists some of the key references that have provided a foundation for our discussion today.

The first reference by Goodfellow et al., from April 2014, explores multi-digit number recognition from street view imagery which paved insights on **different methods to** **handle multi digits marks.**

Following that, we have a work by Lecun et al., which lays out the fundamentals of gradient-based learning applied to document recognition. **This gave us insights on preprocessing the input and OCR techniques to recognise the digits.**

In our third reference, Dixit, Kushwah, and Pashine delve into handwritten digit recognition using both classical and deep learning algorithms, **providing insights relevant to our discussion on pattern recognition.**

The fourth reference by Anagnostopoulos et al. discusses a license plate-recognition algorithm, where a real-world application of digit recognition has been applied which **gives inputs to implement our project to a more usable form**