Capstone Project Proposal

Ghadeer Alodaib - EduVision

Business Goals

Project Overview and Goal What is the industry problem you are trying to solve? Why use ML/AI in solving this task? Be as specific as you can when describing how ML/AI can provide value. For example, if you're labeling images, how will this help the business?	During the challenging time in 2020 a majority of businesses and school has transformed their work activities to be online. For schools in particular, that was a whole new experience to teachers and students. All classes were offered online in a setting of a 30 – 40 mins online meeting for each subject period. For some students and teachers that was a better alternative to attending school. But for others it was a struggle due to lack of engagement and some other reasons. Therefore, to measure the student's satisfaction and degree of engagements during online classes, we are going to introduce a digital solution where we can analyze recorded video of online classes and study the students' emotions based on their facial expression to measure students' satisfaction derived from happy or sad facial expression and other emotions. **EduVision** is a solution that will use deep learning to classify images captured from video recording of an online class and use a classification model trained using a dataset of pre-labeled facial images of people of the defined age range. The dataset has the following set of emotions as labels {Happy, Sad, Neutral, surprised, Angry, Fear, Disgust}.
Business Case Why is this an important problem to solve? Make a case for building this product in terms of its impact on recurring revenue, market share, customer happiness and/or other drivers of business success.	As demonstrated in researches, Students' attention and focus are improved when they are actively involved in the learning process. They are also motivated to practice higher-level critical thinking abilities and have more meaningful learning experiences. In our solution we aim to help schools and education professionals in assessing the quality of online classes and identifying area of improvements. One of the ways is to get the students feedback after each class but this solution seems impractical with elementary students aged (6-11 y/o). And here comes the need to introduce an AI solution to help schools and educators to identify area of weakness and improve it to increase students' engagement, satisfaction and improve the overall quality of the online experience.

Application of ML/AI What precise task will you use ML/AI to accomplish? What business outcome or objective will you achieve?	The solution will use ML in classifying images taken from recorded video into 7 categories {Happy, Sad, Neutral, surprised, Angry, Fear, Disgust}. It will use a Google Vision API that has a pre-trained classification model trained to assign labels to the images and then classify them into the 7 categories. **System Main Functionalities:** I. **Capturing images:** The system will review the recorded video of an online class and capture image every 5 mins and store them to be processed by and image detector. II. **Face Detection:** The detection process will use Vision API face detection module that will detect all the faces in a certain frame and return a response with bounding boxes on all detected faces. It also can give a confidence rate for a detected emotional state for each image. This might be used for comparison and evaluation activities with the classification model. III. **Classifying images:** with a special code, images can be extracted as Individual image for each student based on the face detection bounding box vertices. The images then will be added to the dataset to be uploaded for classification. The user will have an account associated with this solution on AutoML. The user will upload the data and the model will predict the results. Alternatively, AutoML can be monitored via our solution using AutoML API to query the operations such as import data, create model and check operation status. The system will display the result for each student as a series of change in labels in a given set of time and the prediction percentage for each label. The result can be easy to understand and evaluate by educators and it will help them to get the insights needed to evaluate the class and its impression on students.

Success Metrics

Success Metrics	Business Metrics
What business metrics will you apply to determine the success of your product? Good metrics are clearly defined and easily measurable. Specify how you will establish a baseline value to provide a point of comparison.	**Gross margin** this metric reflects on improved processes and production. A 10% margin can be considered healthy and decided as a baseline. **Sales Growth Year-to-date** indicates the pace at which your company's sales revenue is increasing or decreasing. A baseline of higher value is an optimistic option for AI products. We aim for a growth of 40% or higher. **Cost of Customer Acquisition** low average as baseline ensures that sales and marketing spend are effectual. **Qualified leads per month** it indicates whether our business is focusing on the proper market with the best chance of gaining new clients. **Customer satisfaction.** Baseline can be the number of received support tickets, evaluation of response time

Data

Data Acquisition Where will you source your data from? What is the cost to acquire these data? Are there any personally identifying information (PII) or data sensitivity issues you will need to overcome? Will data become available on an ongoing basis, or will you acquire a large batch of data that will need to be refreshed?	The data needed for this product are: Test data: the test data will be used for training the model and testing the modules. We will use opensource dataset known as Natural Human Face Images for Emotion Recognition in Kaggle prepared by researchers and shared in many formats in Kaggle. This data is opensource with open license for use by public. The dataset consists of 1,000 images for training and 100 for testing in each category a total of 7,700 images. Actual data: is the dataset used by the product users to generate the intended outcome. This dataset will be captured from the recorded video of online classes in a form of images. And a dataset will be created from these images. For the students images a consent of agreement signed by parents is necessary to include the student image in the dataset. A proper documentation is necessary to illustrate the best practice to protect sensitive data. One way is to attach none of the students' personal information in the dataset that could clearly identify a student such as his name. A generated system ID will be used as an image name ad will be unique to each student. A reference to this ID is kept confidential in the school records. Data availability**:** actual data will be prepared for analysis on an ongoing basis. It will be collected for each online class.
Data Source Consider the size and source of your data; what biases are built into the data and how might the data be improved?	Test data: bias is likely to be found in the test data and it can be eliminated or removed by selecting equal number of images for each label in the training data set to improve the model's performance. Actual data: bias can be caused by the model or by the similar reaction captured in students' images which will not be a concern since the emotion was captured accurately.
Choice of Data Labels What labels did you decide to add to your data? And why did you decide on these labels versus any other option?	The data labels reflect the students emotional state in a certain point of time. And based on this label, several points can be measured such as students' engagement, student satisfaction, enjoyment level, and boredom.

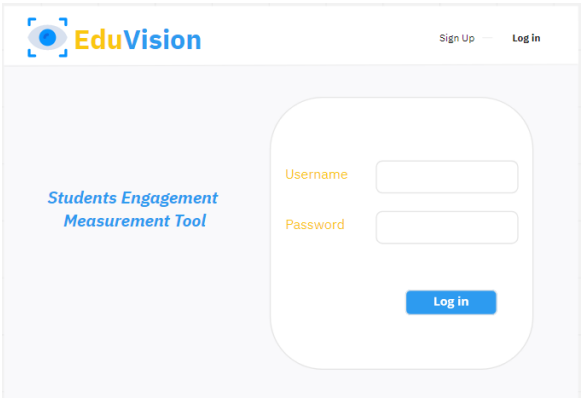
Model

Model Building How will you resource building the model that you need? Will you outsource model training and/or hosting to an external platform, or will you build the model using an in-house team, and why?	In our product we will be using Google AutoML vision to host the model training and deployment. and additional functionality such as face detection will be built by our team of developers and integrated with Vision API. The reason of using Google AutoML platform is for it is high quality trained models built by google expertise. It also streamlines all the steps required to build a model it reduces the complexity of developing, testing, and deploying machine learning models.
Evaluating Results Which model performance metrics are appropriate to measure the success of your model? What level of performance is required?	The performance metrics appropriate to measure the success of our image classification model are: **Precision:** which is the ratio of true positives to predicted positives. It measures the number of images the model predicted correctly in its class compared to all predictions **Recall**: is the ratio of true positives predictions to actual positives. A precision and recall value above 80 % will be acceptable

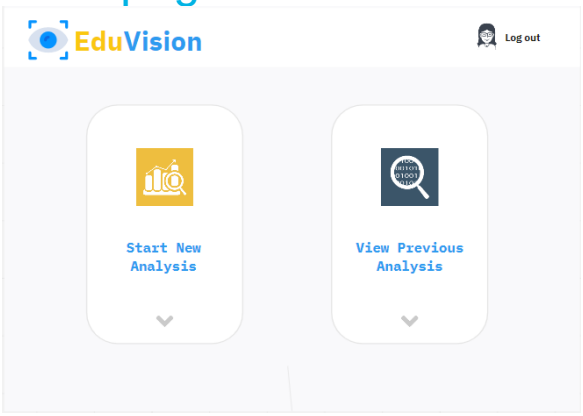
Minimum Viable Product (MVP)

Design

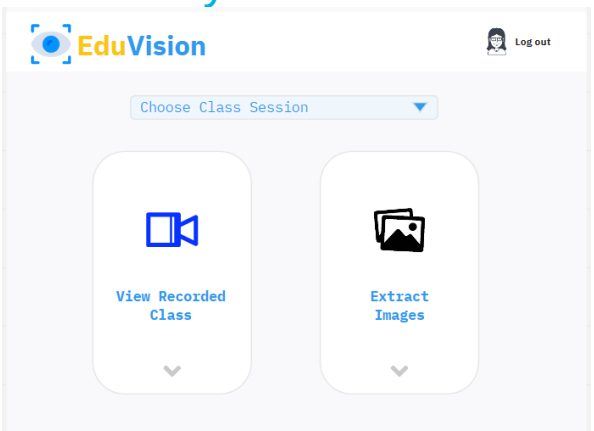
What does your minimum viable product look like? Include sketches of your product.



Main page



New analysis



Extract images

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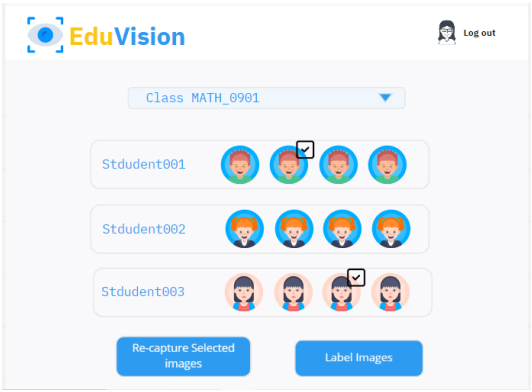
<td></td>
<td> 

Results

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<td>Use Cases

What persona are you designing for? Can you describe the major epic-level use cases your product addresses? How will users access this product?</td>
<td>We target school with high class education promoting high quality service and moral excellence.
Our service is directed to schools that seek to provide the best educational experience for their students, maximizing their benefit from the time they spend in the classroom and making it as enjoyable as possible. Through our service, the school can measure students' happiness and satisfaction with teachers and the class content and evaluate their experience using modren technology.

EduVision is a cloud-based SaaS with a monthly subscription model. it provides high security and privacy for customer data.</td>
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<td>Roll-out
How will this be adopted? What does the go-to-market plan look like?</td>
<td>Pre-launch plan:
• Test the models ensure it functioning as required.
• Ensure customer hardware are meets the product minimum specification
• Ensure deploying any customer required customization

Post-launch plan:
• Monitor the system
• Assign dev team to deal with any reported bugs.
• Plan system improvements
• Collect and analyze customer feedback</td>
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Post-MVP-Deployment

Designing for Longevity How might you improve your product in the long-term? How might real-world data be different from the training data? How will your product learn from new data? How might you employ A/B testing to improve your product?	To improve the current product provided for school. We will use the actual data collected from classes to train the model to achieve higher accuracy. And use more unconstrained dataset to train the model and optimize its performance. The product is based on machine learning algorithms and classification model provided by Google AutoML using NAS algorithms the tool will analyze your uploaded data and find the right architecture, which means that our product can be generalized easily to support any business not just the schools but also can analyze the emotions of employees attending meetings or individuals in courts etc. by training the model on large dataset of different subject. To reach customer satisfaction, we will keep improving our models by training on recent data, modify the selection of the threshold or remove/add categories to the dataset that matches the customer desire. Performing **A/B testing** on current models and new models can be an effective step in validating the right model and the version of the product before or after being put in production.
Monitor Bias How do you plan to monitor or mitigate unwanted bias in your model?	Bias in any category can be mitigated by training the model on clean balanced dataset. Balanced dataset will help monitor and spot model bias toward any class. If bias is present toward any class, more images in the rest of the classes can be added to the dataset specially classes where the model fail to predict correctly.

Thank you

Ghadeer Alodaib