**Writing 1:**

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QA classifier Proposal

Multimedia usage has increased significantly in the past decades due to the fast-technological development and the popularity and intense usage of the internet worldwide. Thousands of videos are uploaded and viewed on a daily basis. For instance, on YouTube, a video-sharing website, “the number of online video platform viewers will amount to 1.86 billion in 2021, up from 1.47 billion in 2017.”(Clement j., 2018). Despite the intense use of multimedia, the number of software or systems that provide multimedia classification and analysis in certain well- needed areas are little to non-existent. For instance, the educational system still heavily relies on its traditional teaching techniques which do not provide the best learning tools to students. Few school systems provide video lectures for courses. Great concepts or techniques are often discussed in office hours, but such knowledge is not available to students that could not physically attend those sessions. Additionally, “96 percent of U.S. internet users aged 18 to 24 years accessed YouTube”.(statistical, 2019).In other words, adult-aged students are the main YouTube streamers. Although, the internet is filled with an excess of information, students often waste time to find videos with contents similar to those covered in classes. The solution to these problems is the implementation of the QA classifier.

The QA classifier is a system which allows video and media input and classifies those videos or media based on their contents. The QA classifier enables the user to easily search information based on keywords or uploaded images. The system also provides web links relevant to the data searched. This system will facilitate learning by significantly reducing the amount of time students spend searching for media relevant to their coursework. Researchers have found that “people retain only 20% of what they hear, 40% of what they see and hear, and 75% of what they see, hear and do (Reisman, 1994)”. The QA classifier will enable students to review course materials and efficiently prepare for exams. Students could also access media shared by professors from other classes or schools. This is a great tool for distance-learning students because it enables them to share the same experience as those students on campus. The QA system applies to areas other than academia. For instance prisons record all telephone conversations and store those records in a database. Unfortunately, those records are not reviewed or interpreted in a daily basis. Major prison incidents such as prison scams often leads authorities to analyze stored records to either determine patterns or newly codes created by inmates. The record review process is time consuming and requires an intensive use of employees.Therefore,, with the QA classifier, the contents from those phone records will be classified under different categories and authorities can search for conceptual videos. The QA system is applicable to a wide range of fields which need, utilize, or store multimedia from the police to companies monitoring their employees’ telephonic interactions with the company’s customers. However, the complete implementation of the QA classifier will only be possible with financial support from investors.

The QA classifier is a great program that will help increase efficiency and productivity. Nonetheless, besides the financial support needed for its implementation there are a few technical aspects that might slow down the implementation of the QA classifier. Some difficulties foreseen with this project are providing an accurate audio to text translation, media classification, and image processing. The difficulty in the audio to text translation section is the accuracy of the translator to provide an accurate translation of audio spoken with people with strong accents or those with vocal cord problems. Media classification can be difficult especially with mispronounced names or incorrectly enunciated words. Classification is another foreseen difficulty as the system needs to be trained to automatically categorize videos specifically to a field. Image processing might become problematic in the processing of graphs or images of illegible handwritten texts. Those problems are solvable. Finally, the QA classifier, is a great system which needs to be funded because it will not only revolutionize teaching and learning in both an academic and professional setting, it will also be a great tool usable by a wide range of fields to improve work efficiency and reduce the manpower needed to accomplish tasks.

Citation:

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Statista, 2019, <https://www.statista.com/statistics/296227/us-youtube-reach-age-gender/>

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Writing 1

QA Classifier

One of the most concerning issues within the teaching community is the difficulty of communicating complex concepts to general student bodies. From homemade lecture videos to notes written on tablets during class, instructors often seek to increase the variety of course material available online [1]. In a world where instructional material is rapidly being digitized, it is imperative to keep students engaged with the right form of media in mind. One type of instructional method that has yet to reach its full potential is video learning. The incredible success of platforms like Khan Academy signaled a great demand for minute-style instructional videos. Hitting ten million unique users in February 2014, the significant uptick of user traffic on the site has been described to have changed the landscape of education and educational platforms [2]. Likewise, Youtube has installed a sub-section specifically dedicated to educational materials in 2018 in response to user demand [3]. However, a consistent bottle neck across all video-sharing platforms is the inability to reduce the time spent looking for specific spoken topics and subjects within videos. As a result, our team proposes to develop an upgraded video searching system which parses and classifies segments of recorded instructional videos for users seeking quick and relevant information, ultimately aiming to optimize and streamline the process of online instructional learning through video and audio mediums.

As students who often engage in the use of multimedia for educational purposes, we recognize that the greatest challenge in learning through recorded instructional videos is the task of finding the exact location of relevant topics. Our system, called the QA Classifier, seeks to not only categorize video material by subject, but also provide time frames in which relevant keywords and topics are spoken. The idealistic instructional platform for recorded video and audio materials should not only return relevant results to the user, but also provide precise times in which certain subject matters are discussed. Because office hours typically take place in spaces that are inaccessible to students who cannot physically attend, instructors are often met with the tedious task of reiterating explanations for multiple students within the same class. Additionally, lectures and review sessions tend to happen in lengths of time that are not considered concise. For these reasons, our system seeks to retain spoken information discussed during office hours, lectures, review sessions, and other educational spaces in segmented video forms such that both students and instructors can easily search for questions and answers pertaining to their class. Menial details such as topic, search terms, and tags should not be required on the part of the user during the video upload process, but instead automated by the application for the purposes of streamlining the practice of uploading recorded instructional material online. Implementing such a system will require machine learning techniques, a web framework, and a method to store the uploaded materials. Prototyping this system can be achieved by employing open-source application frameworks such as Angular and Flask. This can be easily built using existing developer platforms today.

While the implementation of our system requires a relatively average combination of existing methods and frameworks, the return value is great. First, there exists no centralized system to fluidly identify audio content within videos and output relevant segments. Second, creating such a system would significantly reduce search time spent on looking for resources within lengthy clips in addition to reducing the time spent including searchable tags on the point of view of the instructor who chooses to upload videos. Some of the technical challenges associated with building our application include implementing the proper machine learning algorithm to correctly classify videos within the system and ensuring the fluidity of our user interface. Applying an algorithm of low accuracy will slow down the classification of audios and videos within our system and create more difficulty in searching for the right instructional material. Moreover, an unfriendly user interface will discourage video use and defeat the purpose of our mission. Because our system requires large sets of data to improve the accuracy of the machine learning algorithm, our system will ultimately require funding for successful completion. Despite these challenges mentioned above, we are confident that the integration of our working system into every day instructional courses will significantly increase productivity and engagement within the classroom. With enough support from investors and the development team, the QA Classifier may have the chance to bring the practice of learning through educational videos to its best potential.

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Weiming Long

Writing 1

QA Classifier

The Internet has become irreplaceable in the field of education that it grants access to everyone with its huge amount of resources. It’s simple for educators to record videos of different fields of study and post them on their YouTube channels as well as other educational videos website. Both teachers and students can benefit from these videos for research purposes and individual study. Websites like YouTube, Khan Academy, MIT OpenCourseWare, and many other educational websites grant everyone easy access to study from millions of educational videos. Several meta-analyses have shown that technology can enhance learning, and multiple studies have shown that videos, specifically, can be a highly effective educational tool. However, with this exponential growth in the number of educational videos, one can find it overwhelming to find a suitable and effective video to study from. The name of our project is called QA Classifier and our purpose is to make a study using online educational video resources.

As a team of college students, we all have been watching videos to tackle difficult problems during our study. Since there are so many educational video resources we can access, it sometimes seems inefficient and time-consuming to find the video that we need. It seems almost impossible for us to choose from so many educational videos websites and so many video websites. A good classification of different topics should be added. The other thing that’s always annoying to us is that many educational videos can be as long as one and a half hours or more. Traversing through the video to find some specific key points is just challenging as finding needles in a haystack. Forwarding the video too fast can easily skip the key points we are looking for while forwarding slowly will be too time-consuming and exhausting. These problems of using current online educational video resources really lowered our productivity and this is the main reason why we want to bring new changes.

In order to use those online resources in a better way, we plan to build a QA classifier that can analyze educational videos and make specific knowledge points much easier to find. Our system is going to be capable of doing audio to text conversion. We first need to let our system to access different educational videos and take out the audio part from those videos. It would also be tricky to convert audio to text precisely due to frequent occurrences of terminologies from different subjects. The clarity of the audio and background noise are crucial problems that we need to solve. After getting scripts from different videos, searching for specific key-terms in long educational videos will be much more accessible. Other than just converting audio to text, our system will also utilize machine learning to mark different key-terms and classify them. It’s a challenge for us to train to system how to identify which words are important and will be searched for. There will be many redundant words that exist in the script. We will implement our algorithms to make the system to identify terms like “Singular Value Decomposition” that belongs to intermediate Linear Algebra. Our system will also use machine learning to analyze the topic and description of the video to make tags and keywords to make classification more accurate. The machine learning part would require a lot of computing power such that we plan to use cloud computing services to achieve our goal. We are going to generate an enormous amount of data that we are also going to build a well-designed database to store our results. The database will have unique IDs for different videos and their links. For each video, there will be tags and keywords for classification as well as the time of some terminologies’ occurrence time. The UI of our system will be user-friendly such that users can search for different subjects and keywords and have the video player right in the middle. The occurrence time of specific keywords will be interactive so that users can just one-click to go to the point in a long video. Our system will dramatically increase the productivity of every learner and which is a positive impact on our society.

Our system proposed by the above plan will bring huge benefits for students and those who want to extend their knowledge. Finding the right educational video and even specific part in that video will make online learning much more efficient and effective than ever before. This system can go even further into different fields to extract and classify information from videos. Our system will benefit not only students but also every single person in our society that want to seek knowledge. We need your generous funding to support our server and database running. Please consider funding our system for better education for our society.

**Writing 2 (revised):**

Comparison with similar projects:

The QA classifier as defined in writing 1, is a video and audio classification system that classifies a video based on its content in a database. Over the past decades, constant research and studies in the field of Machine Learning and Artificial Intelligence have led to the creation of a multitude of software similar to the QA classifier that provides video and audio analysis and classification. However, software that provides the same functionality as the QA classifier have yet to be found.

Currently, there are systems that provide functionalities similar to ours but are designed to be used in fields other than education.Although our system can be applicable in many fields such as Human Resources, and interviews, its main focus or target audience is in Education. Software that provides functionalities similar to those of the QA classifier has applications in many fields including sports, government, and financial institutions. For instance, Kinovea is a software company whose core missions relates to the study of human motion through capture, observation, annotation and measurement.

Similarly to the QA classifier, kinovea provides a database where users can upload videos online and after throughout analysis. The software classifies the uploaded videos into different categories to enhance the user’s search experience. Kinovea, does an in-depth imagery analysis of videos. Kinovea is used in sport to provide feedback on sport performance among athletes. For example, in a video with an athlete weightlifting, Kinovea analyzes the images and provides an analysis of proper weightlifting techniques. Kinova adds “basic annotations like labels and numbers, lines and arrows, curves, multi-line paths, rectangles, markers, freehand drawings”[1] . The QA classifier and Kinovea differ on the type of data utilized for the analysis. While the QA classifier utilizes, audio data from videos, kinova utilizes videos image data.

Another software with functionalities similar to our system is CallRail. CallRail analyses and interpret recorded phone conversation to provide companies valuable information on the state of sales and service organization [2]. Companies that provide telephone call services are in the constant need to improve customer satisfaction and service quality. Callrail filters Calls by Duration, utilizes call tags, and sorts calls by Agent. All those implementations help in the feedback process and employee training leading to an improvement in employees quality of work and the company's revenue. The QA classifier implements those same functionalities. Uploaded video lectures in our system transcribes audio into text, and based on the Machine Learning and text analysis algorithms used, videos will be tagged automatically and classified by topics. Process which will be useful in an education setting.

Since our goal is to improve the education system, the video will be tagged based on specific topics within a class. Our system will be able to label fragments of a video where a specific topic is mentioned. If a Biology lecture was uploaded in our system and in that lecture, the professor can talk about many topics among which the theory of revolution. If a student was to search for the theory of revolution, instead of going through a lengthy Biology video, the system will return the time frames from videos in our system where the Theory of Revolution is mentioned starting from most relevant to least relevant video.

Currently, there does not exist a software similar to the QA classifier in the education system. As shown, above, there are companies that implement similar concepts and ideas as our system but with an audience in fields other than the education and do not provide all the functionalities our program provides. The QA classifier will greatly improve efficiency and productivity in the educational system. The implementation of our system on a daily basis in the educational system will make the life of students and instructors easier. Instructors will not have to repeat their explanation of the same concept every time or manually tag all the videos uploaded online. Students will now be able to effectively learn the course materials covered in class and easily review exams.

Work Cited:

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Target Audience:

Video has become an important part of education. It is integrated as part of traditional courses, serves as a cornerstone of many blended courses. Our system’s main target audience is all kinds of students. Nowadays, students from different age groups tend to make use of new technologies to enhance their study. Internet services and portable devices like cell phones and laptops have become so common in students’ daily lives. Besides using the internet for social and entertainment purposes, using the internet for learning has also become more and more popular among students. There are tons of educational video resources online throughout different subjects and fields that can be used to extends one’s knowledge. Those educational video resources range from homemade videos, lecture recording posted by instructors as well as open courses from different universities. We, as college students, have always been facing the situation when we don’t quite understand some specific topics covered during a lecture. As we want to study that specific topic, notes taken during lectures are not enough. Then online educational video seems to be the best solution to tackle the difficulties. However, it is time-consuming to find a suitable video in so many videos that is like finding a needle in a haystack. Our system seeks to provide an optimal experience in finding a suitable video that will dramatically reduce the time spent on finding educational videos thus increasing the productivity in the study. Our system will meet most student’s needs for an easy and efficient way to find the right timestamps in those long videos thus it would be popular among students who are looking to make use of online educational video resources.

On the other side, as the online educational video market is booming, the remote teaching opportunities are also expanding exponentially. Educators can also be using our system for uploading their videos to share their knowledge. Videos uploaded from educators will be analyzed and classified by our system for the student to access them. There are many educators who have posted their videos on YouTube that can’t get many views. Our system is going to provide those educators with a better platform and will encourage them by paying those educators who are making high-quality videos that are useful to student users. With our plan targeting both students and educators, we need to have a good business model to make our system work.

To make our system free to every student, our system’s business model is going to be an optional subscription business model that customers are going to pay a recurring price at regular intervals for getting premium access in our system. The access to our system will be free for everyone as it would be more preferable than paid subscription by most students. We are making our system free since it will certainly bring positive impacts to our society. With students having better education, we will have a more prosperous society and social welfare. There would also be a subscription option to get premium access to our system which will get all the ads removed for a better experience. We are going to use the profits from premium subscription to reward those educators that are making helpful videos for our student users. This will become a benign cycle that educators are going to produce more high-quality educational videos while the profits from premium subscriptions are going to be used to reward those video creators. Once our target audiences start using our system, the improvement in their learning will keep them using our system. They will find our system to be unique and can’t be replaced in their study.

Social and Global Impact:

One of the most important outcomes with the rapid development of technology is that it allows for the creation of tools and devices that save large amounts of time [1]. Although many different sub-fields of technology have significantly improved in time-saving abilities within the last few decades, searching through the contents of videos is a process that has always lagged behind in advancement. Our QA Classifier application seeks to address this issue through an implementation of video parsing centered around educational videos. Just as we are able to perform instant search operations of keywords through text documents using a few keyboard commands, our system has the potential to speed up the process of searching for specific words contained inside video contents with the click of a button. More importantly, the QA Classifier is meant to revolutionize the way we approach the use of video and audio mediums in the field of education. The use of instructional learning through video is still considered quite traditional or absent throughout many educational institutions; instructors will often upload lengthy clips of lecture which requires students to spend a significant amount of time searching in order to find topics of interest. Despite the growing number of institutions incorporating the use of video and audio mediums within their classrooms, the challenges associated with its use is often the same. If implemented correctly, our system can accelerate the process of learning through video and audio mediums by enabling wider and more convenient online access to specific instructional material made by instructors through recordings. With this new system, instructors will then have the opportunity to direct students to large records of topics discussed within lectures, office hours, and review sessions, and the students, in turn, will have the tools to search for specific keywords within these videos without spending significant amounts of time searching through them. This process, we hope, will place more emphasis on swift learning and information absorption through video and audio mediums rather than emphasis on searching and scrolling through material online.

Beyond using our system within the United States, the QA Classifier, which is built as a web-application, may be available to any student or educational institution that has internet access. This is a wonderful characteristic of our application as it does not limit the use of the system to specific communities. Foreign institutions that wish to incorporate accelerated learning through video may choose to use the QA Classifier on the web. Furthermore, because our system is meant to capture most of the information shared within closed educational spaces on a given educational setting, it has the potential to greatly improve the experience of distance learning students worldwide.

Although our system is specifically centered around educational development, the invention of this system will have greater implications in the worldwide realm of technology. The QA Classifier has the potential to be applied to any system which incorporates the use of a large database of recordings. If applied in another context, the system’s algorithms can be trained to pick up keywords of interest of a different field. For example, presidential candidates are known to receive widespread media coverage through live interviews and debates but often fluctuate on their stance over certain issues [2]. Our system can be used to search and organize recordings of presidential debates, interviews, and speeches to look for the use of certain key terms such that the analysts do not need to spend large amounts of time searching through all the videos to look for a specific response. The QA Classifier has the potential to be a powerful tool, and thus there may be a few negative repercussions if used incorrectly. Because the QA Classifier is dependent on the data over which it is trained, feeding the algorithm incorrect or falsified data can produce a faulty system. However, because the QA Classifier is meant to only find the key terms and its synonyms inside the videos rather than to attach meaning to the clips, we predict that misuse with our system alone will be rare and will not require significant regulation. Overall, the QA Classifier has the potential to be an extremely useful and versatile tool because of its ability to parse and classify video and audio mediums, and while the general framework of our system may be applied to other fields to support the classification of non-educational recordings, our team hopes to increase the impact of educational learning through video by using our application worldwide.

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**Writing 3:**

Technical innovation:

Our system is going to be implemented with various rapidly growing technologies such as speech-to-text transcription, cloud database, natural language processing and machine learning. All of these technologies have been applied in various fields such as business analytics and data science, but they are not commonly used in the field of education. Our system of educational video classification combined with above technologies is new and unique in the market.

Among the technologies we are going to use in our system, the Speech-to-Text transcription is using the emerging cloud computing. We are also using Google Cloud Services’ Audio-to-Text API. Cloud computing can utilize the strong computing power of cloud servers and reduce the cost of purchasing and maintaining physical computing equipment. This means we do not need to worry about the limits of computing capability. The Speech-to-Text API from Google uses Google’s most advanced deep-learning neural network algorithm and keeps improving its accuracy over time. It can handle noise from many environments without requiring additional noise cancellation, which is crucial because many videos recorded in class can have different noises, such as students moving around or discussing in the back. One more important feature is the speaker diarization which can distinguish the speech of the instructor from other students. Besides these products mentioned above, we are also going to use a cloud database from Amazon Web Services. With this type of storage, we can store a vast number of educational videos and audio extracted from them as well as their transcribed text files. Our system can take advantage of the scalability of cloud databases such that it can be scaled quickly and efficiently. The web frameworks we are using for the front end are Flask and Angular. With these web frameworks, we can develop our lightweight website easily. In the machine learning part, our system is going to a library called GenSim in topic modeling as well as Scikit-Learn for TF-IDF. These methods are new and have been growing rapidly these years.

Combining all above technologies together, our system is unique in the field of educational videos. Our system is technically novel in that we put together cloud computing, modern web framework and various machine learning models into one place. We are using Speech-to-Text technologies on those educational videos for classification in a way that has never been used before. By utilizing the ability of cloud computing and modern machine learning techniques, the cloud servers we are using can transcribe and classify many videos in a short period of time; this could not be accomplished ten years ago. Our system is going to provide a whole new solution for students using educational videos in their studies. There are currently many different educational video websites. It is hard to find a suitable video because not only are there many options, but many videos can also be hours long. Our system is going to be a hub that collects all these resources together and classify them. It would be much easier and more efficient using our system because there will be classification and time stamps for different topics.

Currently, there exists no system on the market for classifying educational videos using Speech-to-Text and machine learning technologies in the way that our system does. There are several systems that are similar, such as CallRail and Khan Academy. CallRail is a system focus in analyzing phone calls using Speech-to-Text and machine learning technologies. CallRail is aiming at marketing and business while ours is focusing on education. Khan Academy is also a website that contains a vast number of educational videos. However, it is still a traditional educational website that is only able to post its videos. It is still hard to find a specific topic inside a chapter. Users must traverse through long videos without the option to search certain topic inside the video or see the timestamps of certain topics. Compared to the above two similar systems, our system is sure to be more innovative and novel in the technical field and will benefit students learning using educational videos.

Technical feasibility:

Many tools and technologies are used by programmers working on different projects. The tools and technologies we will use in our project are the Google Speech-to-Text Application Programming Interface (API), FLASK, Angular, Term Frequency and Inverse Document Frequency (TF-IDF) vectorizer, GenSim, MongoDB, and Amazon S3 (AWS).

One of the software products used for a portion of our project is the Google Speech-to-Text API, used to transcribe audio track from a video file to text files. This API enables us to transcribe videos of any length to any type of file extension of a given language. It will also help provide accurate transcriptions for videos containing speakers with a strong accent.

Next, the text files obtained from the Google Speech-to-Text API will be prepared and used for predictive modeling in our machine learning program. TF-IDF is a popular method used to calculate word frequency. The Term Frequency portion of TF-IDF summarizes the frequency of words in a document, while the IDF portion assigns low weights to terms that are frequent among different documents. The TF-IDF model provides a frequency score that highlights the most interesting and distinctive words or words that are not frequent among all documents. For machine learning, we will specifically utilize the TF-IDF vectorizer which “tokenize[s] documents, learn[s] the vocabulary and inverse document frequency weightings, and allow[s] you to encode new documents” [1].

Another machine learning tool used in our project is Gensim, a natural language processing tool used specifically for topic modeling. Topic modeling provides topics from a large volume of texts by implementing Latent Dirichlet Allocation (LDA) algorithms. A great advantage with GenSim is that it is an unsupervised machine learning algorithm that finds previously unknown patterns in data without the need of training the machine on different labels, contrary to supervised learning algorithms. This is especially important for our project because we want to be able to provide accurate topics or labels for any lecture video uploaded into our system and provide consistent and precise topics that are not just based on pre-provided labels.

TransitionTo properly store and retrieve videos from our system, we will also use Amazon S3 and MongoDB. Amazon S3 is a part of the Amazon Web Service (AWS), which will enable us to set up the infrastructure to support MongoDB. MongoDB is a NoSQL database which provides support for “JSON-styled, document-oriented storage systems. It supports a flexible data model that enables you to store data of any structure, and provides a rich set of features, including full index support, sharding, and replication” [2]. Citation must always be followed by an explanation or analysis of it.

TransitionThe programming language used to implement the different kinds of software mentioned above is Python. Therefore, the front-end web interface that we will use needs to be compatible with both Python and the other previously mentioned tools. Thus, we decided to use a full stack development environment using both Flask and Angular. Angular is a Javascript framework used in front-end development to build web applications. In our project, we will use Flask, a web application framework for the backend.

TransitionFor the past month members of our team have worked with different technologies explained above. Based on the knowledge we acquired and the different research we did, we strongly believe that this project is feasible. We all have a strong understanding of the capabilities of the software we worked on and are able to fully work on this project.

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Cost, risks, and risk mitigation:

While many development projects involve complex cost analysis for both hardware and software components, the QA Classifier incurs zero cost in hardware due to the fact that it relies solely on software products for its development. For this reason, our team conducted research specifically on the trade offs between various Abstract Programming Interfaces (API) and data storage choices available to us online. Some of the choices we considered for our cost analysis included: Amazon Web Services (AWS), MongoDB, Firebase, Google Cloud, Microsoft Azure, SKLearn, and GenSim. Among these choices, AWS and MongoDB were selected for video and metadata storage, while Google Cloud, SKLearn, and GenSim were selected as the main three APIs to be incorporated into the core components of our application. These five products were selected not only because they best fit the needs of our system, but also for their reasonable pricing rates. AWS, MongoDB, and Google Cloud offer free tier options that would enable the prototyping of our system at zero cost. Additionally, SKLearn and GenSim offer free access to developers seeking to use machine learning within their applications. Thus, developing the initial prototype of the QA Classifier would need little to no monetary support. Beyond prototyping, charges for data storage and API usage in maintaining a real web-application would depend exclusively on the amount of user traffic and service requests made from our system. Because AWS, MongoDB, and Google Cloud all offer a per gigabyte and per request pricing system, calculation of the total cost with a known average usage rate would be rather straightforward. Using the Amazon S3 Standard for video storage, for example, would require $0.023 per gigabyte for the first fifty terabytes used per month [1]. Although cloud services such as AWS and Google Cloud tend to be relatively cheap, finding the average monthly cost of maintaining our application is currently unattainable due to the absence of user usage rates. Calculating monthly or annual costs of the QA Classifier would require more knowledge about the average use of our system further into development.

With the above mentioned analysis in mind, our team conducted another investigation into the possible number of lines of code needed to develop the QA Classifier. Currently, our team has deduced that the estimated lines of code for our system may be somewhere around one thousand five hundred to two thousand five hundred lines. This is due to the fact that our current implementations of various APIs and front-end functionalities total to be about eight hundred lines of code, with the bulk of this number being from the front-end application code. Because we plan to incorporate additional functionalities to our user interface, which requires front-end programming, we estimated that our final number will roughly double as our application development comes to completion.

As our team makes increasing progress towards developing the first prototype of the QA Classifier, we believe it is important to mention a few upcoming milestones. The first milestone to be achieved involves rudimentary implementations of our chosen APIs and application frameworks for the QA Classifier. This will be achieved on October 23rd during our first demonstration. The next milestone involves further advancing our individual implementations and integrating each piece into a comprehensive development platform. Next, our team plans to utilize this shared platform to fully implement the core components of our application by bringing the main functionalities, the video parsing and keyword tagging, to completion and by making them available on the user interface. Finally, as an extra functionality, our team plans to implement a web-search feature that would allow users to view videos and web pages that are similar to the ones uploaded into our system inside the QA Classifier. Achieving this additional feature would be our last and final milestone. Each milestone, except the first and last, is estimated to take about a month and a half to complete. Because the last milestone is meant to be an additional feature, completion time may vary depending on the rate of development for our main features. Regardless of completion time, development for the the final milestone will certainly take place in Spring 2020.

Works Cited:

[1] “S3,” *Amazon*, 2002. [Online]. Available: <https://aws.amazon.com/s3/pricing>. [Accessed:

22-Oct-2019]