Skin Cancer diagnosis using Artificial Intelligence on the Cloud

DESIGN DOCUMENT

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Revised: 12/3/2023

Executive Summary

Development Standards & Practices Used

List all standard circuit, hardware, software practices used in this project. List all the Engineering standards that apply to this project that were considered.

- IEEE 730
- IEEE 828
- IEEE 29148
- IEEE 1012
- IEEE 16326
- IEEE 24748
- ISO/IEC 29119

Summary of Requirements

List all requirements as bullet points in brief.

- Web Interface to access model
- Ability to access model from around the world
- Able to input images to receive results
- Google or AWS cloud environment
- Access to the data required to create a cancer model
- High power GPU computer
- The model should follow a consistent design pattern in terms of UI
- The project should take zero funding to make (constraint)
- Interface that is easy to use and navigate
- Model is able to output results within seconds or little to no delay
- Ensuring that the photos provided from medical institutes are acceptable to use.
- The model should be able to gracefully degrade as it gets more advanced and should continually upgrade itself as it learns more through its neural network.
- Make sure model runs as intended and is able to give accurate results

Applicable Courses from Iowa State University Curriculum

List all Iowa State University courses whose contents were applicable to your project.

COM S 309

COM S 319

SE 317

New Skills/Knowledge acquired that was not taught in courses

List all new skills/knowledge that your team acquired which was not part of your Iowa State curriculum in order to complete this project.

Working with AWS and GCP, setting up an AI model, and training an AI model.

Table of Contents

List of figures/tables/symbols/definitions (This should be the similar to the project plan)

1 Team, Problem Statement, Requirements, and Engineering Standards

1.1 Team Members

Megan Eberle, Evan Nim, Alexander Lafontaine, Abigail Thompson, Bariture Ibaakee, Breann Grant

1.2 Required Skill Sets for Your Project

- Be ready and willing to learn (AI and Cloud technologies)
- Good knowledge of programming language
- Good Communication
- Experience with Gitlab
- Good time management

1.3 Skill Sets covered by the Team

Evan Nim - All the skills

Abigail Thompson - All the skills

Alexander Lafontaine - All the skills

Breann Grant- All the skills

Megan Eberle- All the skills

Bariture Ibaakee-All the skills

1.4 Project Management Style Adopted by the team

- Basic Agile like project management

1.5 Initial Project Management Roles

Team Organizer (Megan Eberle): Lead and organize team meetings.

Client Interaction (Evan Nim): Speak on behalf of the team when communicating with Professor Gaffar and our TA

Tester (Alexander Lafontaine & Abigail Thompson): Design use cases and test cases, and test the software, system, and requirements.

Record Keeper (Evan Nim & Bariture Ibaakee): Keeping track of meeting minutes and accurately keeping record of what goes on in each meeting.

Project Organizer (Breann Grant): Keeps Github regularly updated and makes sure that everyone has it updated as well.

1.6 Problem Statement

What problem is your project trying to solve? Use non-technical jargon as much as possible.

Our project is trying to help aid in the process of detecting skin cancer. We want to be able to have AI diagnose skin cancer when given an image. This will be useful for doctors and for patients. This AI model will also be hosted on a Cloud platform. This will allow for easy access to other doctors. The data that this uses is also very sensitive, so we will ensure that all of the data is secure and that only authenticated users will have access to the AI model.

1.7 Requirements & Constraints

List all requirements for your project . This includes functional requirements (specification), resource requirements, qualitative aesthetics requirements, economic/market requirements, environmental requirements, UI requirements, performance requirements, legal requirements, maintainability requirements, testing requirements and any others relevant to your project. When a requirement is also a quantitative constraint, either separate it into a list of constraints, or annotate at the end of requirement as "**(constraint)**". Other requirements can be a single list or can be broken out into multiple lists based on the category.

Functional requirements:

- Web Interface to access model
- Ability to access model from around the world
- Able to input images to receive results

Resource requirements:

- Google or AWS cloud environment
- Access to the data required to create a cancer model
- High power GPU computer

Qualitative aesthetics requirements:

- The model should follow a consistent design pattern in terms of UI

Economic/market requirements:

- The project should take zero funding to make (constraint)

UI requirements:

- Interface that is easy to use and navigate

Performance requirements:

- Model is able to output results within seconds or little to no delay

Legal requirements:

- Ensuring that the photos provided from medical institutes are acceptable to use.

Maintainability requirements:

- The model should be able to gracefully degrade as it gets more advanced and should continually upgrade itself as it learns more through its neural network.

Testing requirements:

- Make sure model runs as intended and is able to give accurate results

1.8 Engineering Standards

What Engineering standards are likely to apply to your project? Some standards might be built into your requirements (Use 802.11 ac wifi standard) and many others might fall out of design. For each standard listed, also provide a brief justification.

Standards:

- IEEE 730
    - This is a software project and therefore should adhere to typical software quality assurance processes, similar to those laid out in IEEE 730.
- IEEE 828
    - We will need to follow the minimum requirements for Configuration management within our project.
- IEEE 29148
    - There will be various development stages required in order to create our model, IEEE 29148 talks about the provisions and requirements for these different stages.
- IEEE 1012
    - We'll need to be able to identify whether or not the given problem (detecting skin cancer) was able to be solved by our software as well as the consumer using it has their problem solved.
- IEEE 16326
    - Since this is a group project it'll be important to identify key points in relation to project management, specifically planning, monitoring, quality management, documentation, etc.
- IEEE 24748
    - Since the project will have a user interface for non-expert audience, it will require documentation or a tutorial.
- ISO/IEC 29119

    - Since the software project involves A.I, rigorous testing will be needed to both train and test the A.I. Therefore, great documentation and testing standards are needed.
- Google or AWS Cloud Environment
    - Cloud computing will help run the software project
- Python Language
    - Almost all A.I. libraries are in Python.

1.9 Intended Users and Uses

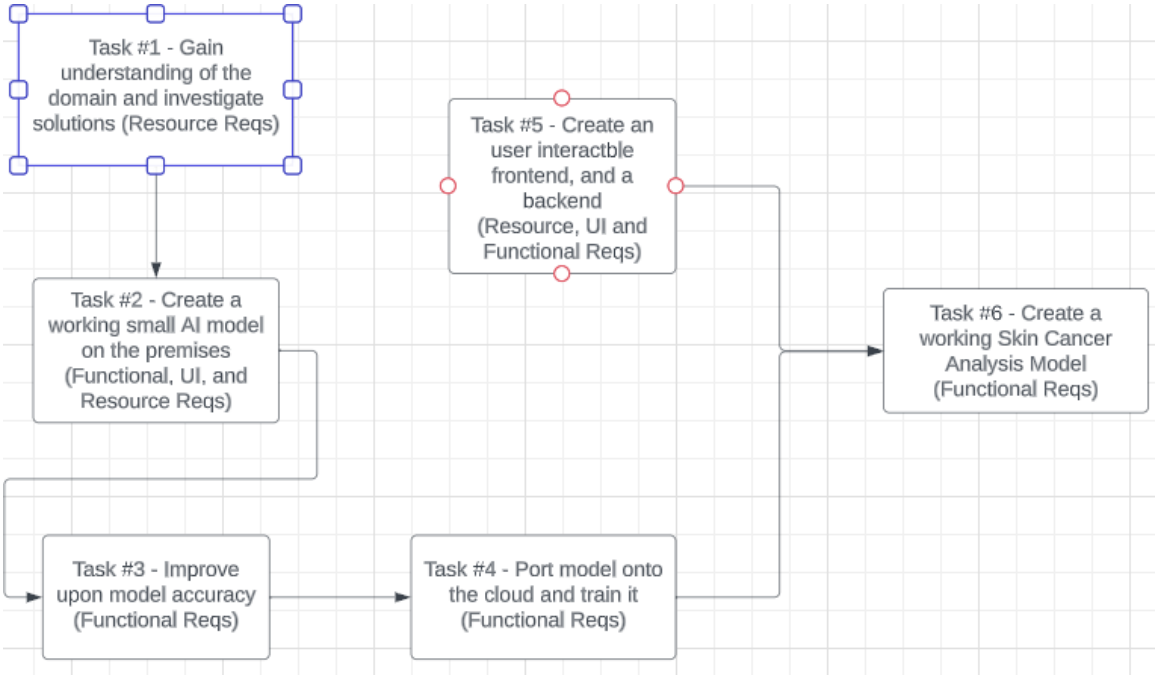
Who benefits from the results of your project? Who cares that it exists? How will they use it? Enumerating as many "use cases" as possible also helps you make sure that your requirements are complete (each use case may give rise to its own set of requirements).

The results of the project will benefit a lot of different people including patients that have skin cancer, doctors who are trying to diagnose skin cancer, patients who do not know that they have skin cancer. The people that will care that this project exists will be every single patient, doctor, family member, or friend that has been or knows someone that has been affected by skin cancer, especially the people that have found it too late. This project also has a very strong appeal to the Mayo clinic because they already have adopted many projects like this one. Patients and doctors will use this project to help get a head start on the prognosis of the cancer to stay in front of it so that they can get the cancerous part removed before it spreads to any more of the body. The project will be working hand in hand with AI to detect possible signs of skin cancer on the body by training simple AI models to recognize the signs of skin cancer by using real images from multiple different medical institutes.

2 Project Plan

2.1 Task Decomposition

In order to solve the problem at hand, it helps to decompose it into multiple tasks and subtasks and to understand interdependence among tasks. This step might be useful even if you adopt agile methodology. If you are agile, you can also provide a linear progression of completed requirements aligned with your sprints for the entire project. At minimum, this section should have a task dependence graph, description of each task, and a justification of your tasks with respect to your requirements. You may optionally also include sub-tasks.



https://lucid.app/lucidchart/c0275ba0-1860-405d-8855-16ddbeeede42/edit?view_items=a32A5n6O6d3z&invitationId=inv_c9ca914a-bf53-44cf-882c-40e168591782

2.2 Project Management/Tracking Procedures

Which of agile, waterfall or waterfall+agile project management style are you adopting. Justify it with respect to the project goals.

What will your group use to track progress throughout the course of this and the next semester. This could include Git, Github, Trello, Slack or any other tools helpful in project management.

Our team has decided to use agile instead of waterfall for our project management. Most of our team members have had experience and are more comfortable with agile as well. With respect to our project goals, agile is also the correct choice. Agile is more of a team-based approach to project management which will allow all of us to learn more about AI. Having designated sprints will also help keep the team on track and learning. In order to track our progress, the team will be using Github Issues. We can use them to track milestones, smaller priorities during sprints, what is in progress, and more.

2.3 Project Proposed Milestones, Metrics, and Evaluation Criteria

What are some key milestones in your proposed project? It may be helpful to develop these milestones for each task and subtask from 2.1. How do you measure progress on a given task? These metrics, preferably quantifiable, should be developed for each task. The milestones should be stated in terms of these metrics: Machine learning algorithm XYZ will classify with 80% accuracy; the

pattern recognition logic on FPGA will recognize a pattern every 1 ms (at 1K patterns/sec throughput). ML accuracy target might go up to 90% from 80%.

In an agile development process, these milestones can be refined with successive iterations/sprints (perhaps a subset of your requirements applicable to those sprint).

1. Training students on AI and cloud computing: 3-4 weeks
2. Introducing students to AI skin cancer practices as done by Mayo Clinic: 2 weeks
3. Starting a small AI model on premises: 4 weeks
4. Improving the model accuracy: 4-6 weeks
5. Porting the model on the Cloud and training it: 4-6 weeks

2.4 Project Timeline/Schedule

• A realistic, well-planned schedule is an essential component of every well-planned project

• Most scheduling errors occur as the result of either not properly identifying all of the necessary activities (tasks and/or subtasks) or not properly estimating the amount of effort required to correctly complete the activity

• A detailed schedule is needed as a part of the plan:

– Start with a Gantt chart showing the tasks (that you developed in 2.2) and associated subtasks versus the proposed project calendar. The Gantt chart shall be referenced and summarized in the text.

– Annotate the Gantt chart with when each project deliverable will be delivered

• Project schedule/Gantt chart can be adapted to Agile or Waterfall development model. For agile, a sprint schedule with specific technical milestones/requirements/targets will work.

week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Train on AI and cloud computing																			
Introduction to AI skin cancer practices																			
Gain knowledge about our domain and investigate solutions																			
Small AI model																			
Improve model accuracy																			
Port model to cloud and train																			

2.5 Risks And Risk Management/Mitigation

Consider for each task what risks exist (certain performance target may not be met; certain tool may not work as expected) and assign an educated guess of probability for that risk. For any risk factor with a probability exceeding 0.5, develop a risk mitigation plan. Can you eliminate that task and add another task or set of tasks that might cost more? Can you buy something off-the-shelf from the market to achieve that functionality? Can you try an alternative tool, technology, algorithm, or board?

Agile project can associate risks and risk mitigation with each sprint.

1. Difficulty transferring AI model to the cloud - 0.3
2. The training for our AI could be off resulting in bad outputs - 0.5 - We would prevent this by starting with smaller models to prevent time being wasted if the model was trained incorrectly.
3. Slow performance - 0.3
4. Refactor UI code - 0.1

5. Difficulty understanding some of the tools - 0.2
6. Not reaching the desired level of accuracy - 0.4

2.6 Personnel Effort Requirements

Include a detailed estimate in the form of a table accompanied by a textual reference and explanation. This estimate shall be done on a task-by-task basis and should be the projected effort in total number of person-hours required to perform the task.

Task	**Projected Effort**	**Reference**
Learn AI and Cloud Computing	20hr total	Learning the AI will take some time commitment to understand the software and coding required for the project
Acquire the Datasets	4hr total	
Set Up Model Environment	2hr total	
Create and train AI Model	8hr total	
Test the AI Model	12hr total	We need to commit enough time to making sure the model works as intended and to find any flaws
Improve Model Accuracy	12hr total	It may take some time to improve the models
Create Model UI	10hr total	We will write the code necessary for a web application

2.7 Other Resource Requirements

Identify the other resources aside from financial (such as parts and materials) required to complete the project.

1. An AI model to base our own on. We will use Keras.io for this.
2. A dataset to train the model with. We will need to find an open source image dataset to use. This will be found from ISIC.

4 Design

4.1 Design Content

Briefly describe what is the design content in your project.

There are three modules that have to be developed for the project to succeed: the User Interface, the Cloud Server, and the Database. The User Interface consists of a website where users can upload a picture for the A.I. to analyze, and later receive the results. The Cloud Server contains the A.I. that must be trained before opening to the public. Finally, the database is the place where the training data is located.

4.2 Design Complexity

Provide evidence that your project is of sufficient technical complexity. Use the following metric or argue for one of your own. Justify your statements (e.g., list the components/subsystems and describe the applicable scientific, mathematical, or engineering principles)

1. The design consists of multiple components/subsystems that each utilize distinct scientific, mathematical, or engineering principles
    a. Database: Contains all the images for training the model
    b. Cloud Server: Contains the Deep Learning A.I.
    c. User Interface: Sends input images and receives output from the cloud server.
    d. Model (neural networks): Structure of the A.I.
    e. Website: Website for users to read, send images, and receive results.
    f. Controller: Communicates between modules and controls the flow.
2. The problem scope contains multiple challenging requirements that match or exceed current solutions or industry standards.

    a. One requirement is being able to provide a diagnosis ourselves based on a patient's info which could be challenging.

4.3 Modern Engineering Tools

What modern engineering tools were used for this design? Their roles.

Keras.io: Used to run models to get familiar with simple AI models

Cloud: Used for setting up the AI environment

User Interface: Used to collect patient information and give back the results of the diagnosis

4.4 Design Context

Describe the broader context in which your design problem is situated. What communities are you designing for? What communities are affected by your design? What societal needs does your project address?

List relevant considerations related to your project in each of the following areas:

Area	**Description**	**Examples**
Public health, safety, and welfare	Our project impacts any person who may have skin cancer as well as doctors by giving them a less invasive option to identify skin cancer.	Reduces need for invasive procedures.
Global, cultural, and social	People who live in regions that get more sun may be more impacted by this project.	People closer to the equator may get more sun than those who live further away.
Environmental	Our project could contribute to climate change by burning fossil fuels and increasing greenhouse gasses.	Since AI uses a lot of computing, it uses a significant amount of energy.
Economic	Our project could decrease the financial responsibility of patients and insurance providers.	Our project provides a non-invasive method of diagnosing skin cancer, which is generally less expensive.

4.5 Prior Work/Solutions

Include relevant background/literature review for the project

– If similar products exist in the market, describe what has already been done

– If you are following previous work, cite that and discuss the **advantages/shortcomings**

– Note that while you are not expected to "compete" with other existing products / research groups, you should be able to differentiate your project from what is available. Thus, provide a list of pros and cons of your target solution compared to all other related products/systems.

Detail any similar products or research done on this topic previously. Please cite your sources and include them in your references. All figures must be captioned and referenced in your text.

Currently there are numerous AI models available and specifically there are already existing AI models that are able to detect cancer.

– If you are following previous work, cite that and discuss the **advantages/shortcomings**

We will be using existing models to create our model. The shortcoming that current models face that we hope to address with our model is accessibility. We will be using cloud computing to help make our model available to a wider range of people. People all over the world will be able to use our model.

– Note that while you are not expected to "compete" with other existing products / research groups, you should be able to differentiate your project from what is available. Thus, provide a list of pros and cons of your target solution compared to all other related products/systems.

-Pros

-Our model will provide more accessibility by incorporating cloud computing and a user interface

-Cons

-We don't have access to the same sophisticated datasets that other models may be trained on

The National Institute of Dental and Craniofacial Research supported an international study on cancer detection using AI/deep learning. The AI model they created can detect cancer by checking abnormalities in cell size and structure. This study successfully determined the feasibility of using AI to detect cancer cells. In addition to this, the National Cancer Institute has written an article on how AI models are already currently in use. Dr. Ismail Baris Turkbey is a radiologist who with the help of his National Cancer Institute team trained an algorithm that is capable of detecting prostate cancer when given an MRI scan. Figure 1 below shows two MRI prostate scans on top of each other. Both scans have cancer present. The right side of the pictures show where the AI model was able to successfully detect cancer. It is able to determine the specific area in which the cancer is present. This was done by training the model on what symptoms are common in cells with cancer.

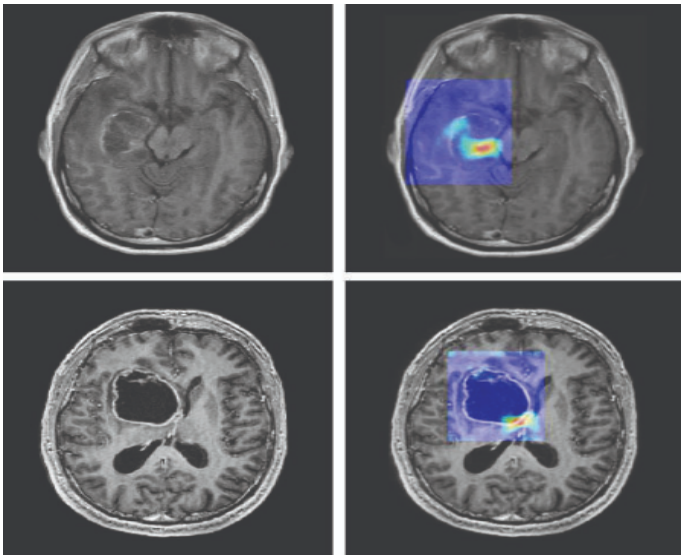


Figure 1 (National Cancer Institute)

Sources:

https://www.nidcr.nih.gov/news-events/2020/exploring-ai-cancer-diagnosis

> "Exploring AI for Cancer Diagnosis." *National Institute of Dental and Craniofacial Research*, U.S. Department of Health and Human Services, www.nidcr.nih.gov/news-events/2020/exploring-ai-cancer-diagnosis. Accessed 18 Oct. 2023.

https://www.cancer.gov/news-events/cancer-currents-blog/2022/artificial-intelligence-cancer-imaging

September 27, 2023, et al. "Can Artificial Intelligence Help See Cancer in New Ways?" National Cancer Institute, www.cancer.gov/news-events/cancer-currents-blog/2022/artificial-intelligence-cancer-imaging. Accessed 18 Oct. 2023.

4.6 Design Decisions

List key design decisions (at least three) that you have made or will need to make in relation to your proposed solution. These can include, but are not limited to, materials, subsystems, physical components, sensors/chips/devices, physical layout, features, etc.

A few key design decisions that will need to me made are:

1. Which cloud server will we use, Google or AWS?
2. What accuracy will we consider satisfactory?
3. What type of database will we use to store the information?

4.7 Proposed Design

Discuss what you have done so far – what have you tried/implemented/tested?

We have been experimenting with simple AI models and also been researching other products/research that have similarities to our project. This has been giving us a good basis for our next steps within our implementation process.

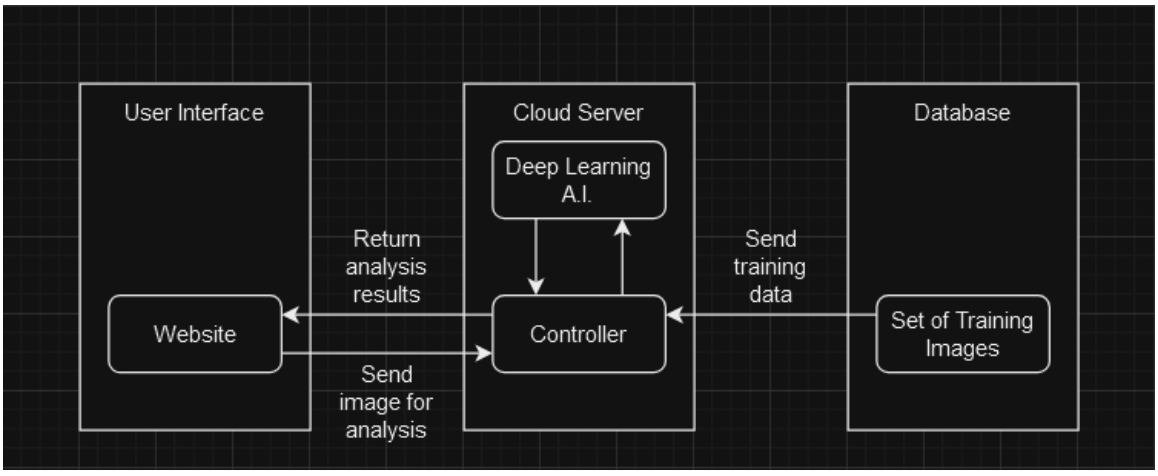
4.7.1 Design 0 (Initial Design)

Design Visual and Description

Include a visual depiction of your current design. Different visual types may be relevant to different types of projects. You may include: a block diagram of individual components or subsystems and their interconnections, a circuit diagram, a sketch of physical components and their operation, etc.

Describe your current design, referencing the visual. This design description should be in sufficient detail that another team of engineers can look through it and implement it.

Justify each component in the design with respect to requirements.



Functionality

Describe how your design is intended to operate in its user and/or real-world context. This description can be supplemented by a visual, such as a timeline, storyboard, or sketch.

How well does the current design satisfy functional and non-functional requirements?

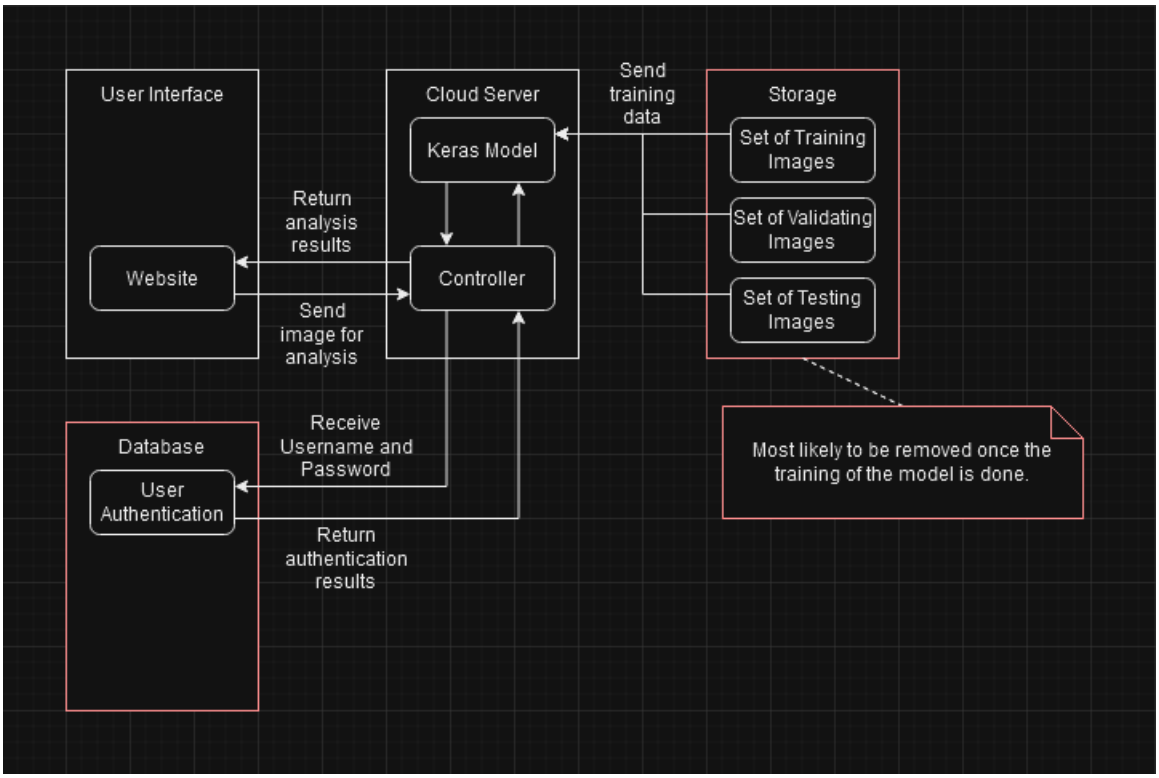
Our design will operate on a computer or handheld device. A healthcare professional will upload a photo of an area of skin, and the application will say whether or not it predicts skin cancer is present in the area.

Right now our current design supports most of our functional requirements, such as being able to interact with a user interface and receive corresponding data. As for non-functional requirements the design doesn't support any one particular non-functional requirement as of now, but as we work on the project, we'll figure out ways to implement them, such as performance, security, usability, etc.

4.7.2 Design 1 (Design Iteration)

Include another most matured design iteration details. Describe what led to this iteration and what are the major changes that were needed in Design 0.

Design Visual and Description



Include a visual depiction of this design as well highlighting changes from Design 0. Describe these changes in detail. Justify them with respect to requirements.

From our initial design we found that a database isn't needed for the images but rather a storage drive or service that can store the images for training. This storage unit will most likely be temporary and only for the training phase of the model. We also understand better how the images are organized for the training of the model, which is why the set of Validating and Testing have been included in the diagram. We anticipate that we'll be adding more onto the design as time goes on.

Additionally, we realized that in order to authenticate users prior to using our service, we will need to store usernames and passwords as well as any other necessary user information, which will be done using a separate database.

4.8 Technology Considerations

Highlight the strengths, weaknesses, and trade-offs made in technology available.

Discuss possible solutions and design alternatives

Strengths:

- AWS and GCP are both well documented cloud platforms
- Keras.io has a lot of models that we can use as a base for ours
- There are many datasets available that we can train the AI model with
- There has already been research done and AI models created that are similar to this project

Weaknesses:

- AWS has a lot of different services, and it can be hard to determine which one to use
- We will have to compare the prices between GCP and AWS
- We will also have to compare the services that GCP and AWS have and figure out which ones apply to our project more.

4.9 Design Analysis

– Did your proposed design from 4.7 work? Why or why not?

No, we ended up making some changes to our initial design. Instead of storing our dataset in a database, we plan on storing it on the cloud.

– What are your observations, thoughts, and ideas to modify or iterate further over the design?

One additional thing we want to incorporate into our current design is an authentication system to prevent unauthorized users from accessing our model and interface.

5 Testing

Testing is an **extremely** important component of most projects, whether it involves a circuit, a process, power system, or software.

The testing plan should connect the requirements and the design to the adopting test strategy and instruments. In this overarching introduction, given an overview of the testing strategy. Emphasize any unique challenges to testing for your system/design.

5.1 Unit Testing

What units are being tested? How? Tools?

Create tests using python that will test the different functions within our code. We will create test cases for all of the main major keras functions that will be called. We will also test units within our UI such as the API calls.

5.2 Interface Testing

What are the interfaces in your design? Discuss how the composition of two or more units (interfaces) are being tested. Tools?

We will test the interface between the user interface and the AI model to confirm that images are successfully sent and the UI receives the result from the AI model. Given that our project is also using a website we will also test the website to make sure that it is processing and sending the information correctly.

5.3 Integration Testing

What are the critical integration paths in your design? Justification for criticality may come from your requirements. How will they be tested? Tools?

Some critical integration paths include the path between the UI interface and our dataset. The UI will need to be able to accurately and efficiently and pull the data from our trained model/dataset. We will test this by testing the UI and making sure that it accurately predicts cancer images. If the interface accurately tests the images it can be concluded that the UI is accurately pulling from the model/cloud. Our model will be stored on the cloud. We have not settled on a tool to use but we are considering using applications such as Selenium and Puppeteer to test the UI.

5.4 System Testing

Describe system level testing strategy. What set of unit tests, interface tests, and integration tests suffice for system level testing? This should be closely tied to the requirements. Tools?

We will use challenges and test images to confirm whether or not the A.I. is behaving accordingly. Plus we will check whether the images from the website are being transmitted properly to the server. Example of system tests include but not limited to:

- Check if A.I. is identifying cancer images 85% of the time.
- Check if A.I. is not identifying cancer images as cancer images.
- Check if A.I. is identifying a group of cancer images and not others.
- Check if A.I. is identifying images with peculiar characteristics instead of cancer images.
- Check if A.I. can identify cancer images outside of the training images.

NOTE: While the tests may sound redundant, the tests are there to make sure that we understand the reasons the AI is giving the results it does. For example, the AI could identify cancer images more than 85% of the time, but these cancer images being detected is because they have the ruler in the image and not because it is cancer by itself. In other words, we want to make sure the AI is detecting cancer because it is cancer and not because of something else in the dataset.

Interface testing can also include but not limited to:

- Check if the interface is in line with the actions it's made to do
- Check if the interface is usable to anyone at first glance
- Check if UI is able to communicate effectively what each thing should be doing

Integration testing could be but not limited to:

Check if the combination of functions and modules work in conjunction with each other

Check if the system is reliable, functional, and performs well

Check if each module of parts of the systems functionality is working correctly

5.5 Regression Testing

How are you ensuring that any new additions do not break the old functionality? What implemented critical features do you need to ensure do not break? Is it driven by requirements? Tools?

In order to ensure that new additions do not break our old functionality, we will make new branches in github for each addition. This will make sure that if we do break old functionality, we still have the previous code that we can look back on. Once we have ensured that the additional code does not break the old functionality, we can merge the branch into the main one. We need to ensure that the overall functionality of the AI does not break when we are adding new implementations.

5.6 Acceptance Testing

How will you demonstrate that the design requirements, both functional and non-functional are being met? How would you involve your client in the acceptance testing?

We will demonstrate that the design requirements, both functional and non-functional, are met by thorough testing. We will have videos that walk through our design and also show the functionality and that it is functional. With our client, we will have them test out the functionality of our application to ensure that it is working properly and that it has all of the implementations needed.

5.7 Security Testing (if applicable)

We will test that the website is only accessible by an authorized user. We will use Selenium IDE to automate UI tests related to login and registering.

5.8 Results

What are the results of your testing? How do they ensure compliance with the requirements? Include figures and tables to explain your testing process better. A summary narrative concluding that your design is as intended is useful.

Looking at the results of other AI within the field we can see that most models end up having an accuracy of 85-90% for detecting melanoma so we predict that our results will fall in line with those percentages once we've gone through and thoroughly tested it more. The accuracy of the testing will indicate whether or not the requirements are met as well as we require that the model be accurate to a certain degree and that clients are able to use it for its intended purpose which is predicting skin cancer. In the end if we're able to get accurate results the design of our project will be useful as it provides a development within this emerging field and an opportunity to expand upon it in the future.

6 Implementation

Describe any (preliminary) implementation plan for the next semester for your proposed design in 3.3. If your project has inseparable activities between design and implementation, you can list them either in the Design section or this section.

For our implementation plan, we want to get our AI model trained first. This is a crucial part of our project, and we want it to be as accurate as we can make it. It will be important to spend a good deal of time training the AI model and making any adjustments necessary. We will also need to be making a website, a controller and a database. These other components can also be worked on in parallel to training the AI. With the database, we already have the set of images and we will need to upload those to the cloud platform we are using.

7 Professionalism

This discussion is with respect to the paper titled "Contextualizing Professionalism in Capstone Projects Using the IDEALS Professional Responsibility Assessment", *International Journal of Engineering Education* Vol. 28, No. 2, pp. 416–424, 2012

7.1 Areas of Responsibility

Pick one of IEEE, ACM, or SE code of ethics. Add a column to Table 1 from the paper corresponding to the society-specific code of ethics selected above. State how it addresses each of the areas of seven professional responsibilities in the table. Briefly describe each entry added to the table in your own words. How does the IEEE, ACM, or SE code of ethics differ from the NSPE version for each area?

The SE code of ethics has been chosen for this section. Principle 5.05 would be a good addition to Table 1. It says, "Develop a fair agreement concerning owner-ship of any software, processes, research, writing, or other intellectual property to which an employee has contributed." With work competence, we know that the employee's have developed the code which shows the integrity and

the quality. Looking at financial responsibility, having employee's develop any sort of software, processes, research, etc. will sometimes be cheaper than having an outside source do it for the company. There should be no deception between the employee's which meets the communication honesty area of responsibility. Regarding health, safety, and well-being, the employee's who are developing this know the company well and are able to continue to keep security practices within this code which ensures safety of information, Principle 5.05 relates to the property ownership area of responsibility the most. The employee's ideas are respected and there is a fair agreement about ownership. With sustainability, this principle can be very sustainable, it simply depends on the resources that they are using. Lastly, is social responsibility. The employee's have a reason for doing this development, and it will most likely be a beneficial development rather than a bad one.

Looking at the IEEE, ACM, and SE code of ethics, they are more in depth compared to the NSPE version. They go into a lot more detail and cover many areas within each principle that they have. The NSPE version is simple and is able to explain each area well.

7.2 Project Specific Professional Responsibility Areas

For each of the professional responsibility area in Table 1, discuss whether it applies in your project's professional context. Why yes or why not? How well is your team performing (High, Medium, Low, N/A) in each of the seven areas of professional responsibility, again in the context of your project. Justify.

Work Competence, High: This area of responsibility does apply to our project. This area states that the quality of work is high, there is integrity, it is able to be done in a timely manner, and the people are professional. With our project, it is important to have high quality work, integrity, have it completed within a timely manner considering our deadline, and for us to be professional when communicating and discussing the project.

Financial Responsibility, Low: Looking at the financial responsibilities of our project, it is mainly pertaining to the cloud platform that we are selecting. We are between using GCP and AWS. With AWS, the free tier will not be enough to support our work, but with GCP the free tier will be enough.

Communication Honesty, High: It is very important that all of us work truthfully and understand what our client needs. If we are missing a crucial implementation, it will be important for our client to communicate with us. Also, the group needs to communicate honestly with each other as well, and have group discussions about issues.

Health, Safety, Well-Being, N/A: Since our project is an AI model, it is all virtual. There is not any way to minimize safety, health, or well-being factors.

Property Ownership, High: This area of responsibility is also very significant to our project. We have been looking at other resources, research, videos, and more to understand concepts of our project more. We will also be using a model from Keras.io for the base of our AI.

Sustainability, N/A: With our project being virtual, there are not many ways to select resources naturally.

Social Responsibility, High: This project will definitely benefit society and communities. This project is to help doctors and individuals with skin cancer.

7.3 Most Applicable Professional Responsibility Area

Social Responsibility

7 Closing Material

7.1 Discussion

Discuss the main results of your project – for a product discuss if the requirements are met, for experiments oriented project – what are the results of the experiment, if you were validating a hypothesis – did it work?

We have not completely completed our project yet but the results that we expect to see once we are done is a fully working model that is available over the cloud and is able to detect cancer when given a picture with at least 85% accuracy.

7.2 Conclusion

Summarize the work you have done so far. Briefly re-iterate your goals. Then, re-iterate the best plan of action (or solution) to achieving your goals. What constrained you from achieving these goals (if something did)? What could be done differently in a future design/implementation iteration to achieve these goals?

Thus far we have gotten acquainted with how AI works and how models are trained and used. We have downloaded our cancer image dataset and have started training smaller subsets of the overall 10000 picture dataset with a keras sequential model. Our goal is to train a model using the entire dataset and set up an environment on AWS/GCP to store our model. We also plan on creating a user interface that will be used by medical professionals. Users should be able to input pictures and get results that determine the likelihood of cancer being present. We haven't completed the user interface yet because we planned on completing our model beforehand. Our plan from here on out is to train some more models and start testing our model. Instead of waiting for the models and training to be complete we plan on working on the user interface concurrently.

7.3 References

List technical references and related work / market survey references. Do professional citation style (ex. IEEE).

https://www.nidcr.nih.gov/news-events/2020/exploring-ai-cancer-diagnosis

"Exploring AI for Cancer Diagnosis." *National Institute of Dental and Craniofacial Research*, U.S. Department of Health and Human Services, www.nidcr.nih.gov/news-events/2020/exploring-ai-cancer-diagnosis. Accessed 18 Oct. 2023.

https://www.cancer.gov/news-events/cancer-currents-blog/2022/artificial-intelligence-cancer-imaging

September 27, 2023, et al. “Can Artificial Intelligence Help See Cancer in New Ways?” National Cancer Institute, www.cancer.gov/news-events/cancer-currents-blog/2022/artificial-intelligence-cancer-imaging. Accessed 18 Oct. 2023.

7.4 Appendices

Any additional information that would be helpful to the evaluation of your design document.

If you have any large graphs, tables, or similar data that does not directly pertain to the problem but helps support it, include it here. This would also be a good area to include hardware/software manuals used. May include CAD files, circuit schematics, layout etc,. PCB testing issues etc., Software bugs etc.

7.4.1 Team Contract

Team Members:

1) Bariture Ibaakee
2) Breann Grant
3) Abigail Thompson
4) Megan Eberle
5) Evan Nim
6) Alexander Lafontaine

Team Procedures

1. Day, time, and location (face-to-face or virtual) for regular team meetings:
   We used when2meet to figure out everyone's schedules and planned on meeting from 3-4pm on Sundays or Mondays at 6-7 pm face-to-face but virtual for anyone who cannot make it in person.
2. Preferred method of communication updates, reminders, issues, and scheduling (e.g., e-mail, phone, app, face-to-face):
   We have a group chat on text where we regularly communicate about everything regarding the project.
3. Decision-making policy (e.g., consensus, majority vote):
   We are going to make a majority of our decisions with a majority vote.
4. Procedures for record keeping (i.e., who will keep meeting minutes, how will minutes be shared/archived):
   We are going to keep track of each meeting, the time, and participants in a shared Google Doc.

Participation Expectations

1. Expected individual attendance, punctuality, and participation at all team meetings:
   a. **We expect everyone to attend all meetings and be on time while giving input and feedback at said meetings. If it isn’t possible for an individual to attend**

a meeting they should be expected to inform the team ahead of time and take the time to read the meeting notes.

2. Expected level of responsibility for fulfilling team assignments, timelines, and deadlines:
    a. **All team members are expected to finish their portion of each assignment/task given to them. It is also expected that they do it in a timely manner and before the deadline is past. If they are unable to complete in a timely manner they should ask the other team members to help them finish said assignment/task.**
3. Expected level of communication with other team members:
    a. **All team members should regularly communicate at least once a week on progress that they are individually making outside of the team meetings. Given any roadblocks, team members should be able to communicate with everyone else that they need help.**
4. Expected level of commitment to team decisions and tasks:
    a. **Every team member should devote enough time to at least provide sufficient enough work that the other team members are satisfied with.**

Leadership

1. Leadership roles for each team member (e.g., team organization, client interaction, individual component design, testing, etc.):
    a. **Team Organization: Megan Eberle**
    b. **Client Interaction: Evan Nim**
    c. **Testing 1: Alexander Lafontaine**
    d. **Testing 2: Abigail Thompson**
    e. **Record Keeper 1: Evan Nim**
    f. **Record Keeper 2: Bariture Ibaakee**
    g. **Project Organization: Breann Grant**
2. Strategies for supporting and guiding the work of all team members:
    a. **Keep an open line of communication**
    b. **Give frequent feedback to all team members**
    c. **Keep a record of all meetings**
    d. **Have a neat schedule**
    e. **Keep Gitlab Issues and Tasks up to date**
3. Strategies for recognizing the contributions of all team members:
    a. **Acknowledge teammate's efforts (tell them they're doing a good job!)**

Collaboration and Inclusion

1. Describe the skills, expertise, and unique perspectives each team member brings to the team.
    a. **Evan Nim: Good familiarity with an Agile system, communication, documentation**
    b. **Alexander Lafontaine: Use case design, System testing, Software architecture**
    c. **Megan Eberle: Python, testing, agile**
    d. **Abigail Thompson: Python, testing, worked with Cloud, Agile**
    e. **Bariture Ibaakee: Testing, General Software Dev skills**
    f. **Breann Grant: Python, Testing, Teamwork**
2. Strategies for encouraging and support contributions and ideas from all team members:
    a. **Everyone throws ideas in a paper/document**

   b. **Make everyone speak what's on their mind when it comes to new ideas and developments**
   c. **Seek input from everyone during meeting when decisions are being made**
   d. **Make everyone feel welcomed in the team**
3. Procedures for identifying and resolving collaboration or inclusion issues (e.g., how will a team member inform the team that the team environment is obstructing their opportunity or ability to contribute?)
   a. **Anonymous box.**
   b. **If comfortable enough, use communication with non-verbal cues (audio, in-person) to avoid tone misinterpretation.**
   c. **Respect the person's issues no matter what it is**
   d. **If an issue is brought up it should be resolved as quickly as possible where all parties involved are satisfied with the outcome**

Goal-Setting, Planning, and Execution

1. Team goals for this semester:
   a. **Working small model**
   b. **Form a good team bond and structure to the team**
   c. **Learn as much as possible of AI and Cloud**
2. Strategies for planning and assigning individual and team work:
   a. **First, each team member grabs a task they are comfortable with**
   b. **Secondly, we assign the rest of the work by analyzing each member's workload**
   c. **Finally work should be divided evenly with all team members**
3. Strategies for keeping on task:
   a. **Update GitLab continually with progress that you've made**
   b. **Keep an active line of documentation in GitLab for other team members to see**

Consequences for Not Adhering to Team Contract

1. How will you handle infractions of any of the obligations of this team contract?
   a. **A warning/discussion should be made with the individual breaking the contract before talking to the TA.**
2. What will your team do if the infractions continue?
   a. **Talk to the TA first.**
   b. **Talk to the professor second.**
   c. **If said individual keeps on making infractions and actively impeding on or disrupting the team flow/dynamic, that member should be removed from the group.**

****

a) *I participated in formulating the standards, roles, and procedures as stated in this contract.*
b) *I understand that I am obligated to abide by these terms and conditions.*
c) *I understand that if I do not abide by these terms and conditions, I will suffer the consequences as stated in this contract.*

1) __Megan Eberle_____ DATE ____9/10/23_____
2) __Evan Nim_____ DATE ____9/10/23_____
3) __Abigail Thompson_____ DATE ____9/10/23_____
4) __Bariture Ibaakee_____ DATE ____9/10/23_____

5) __Alexander Lafontaine_____DATE ____9/10/23_____
6) __Breann Grant_____ DATE _____9/10/23____