Previous Goals:

Our team had two major goals that we wanted to make progress towards. One goal was to fully build and launch the neural network. This would involve meeting with our project sponsor to fully label all burns according to severity so that all labeled images can be integrated into the network. Additionally, we wanted to begin developing the user interface aspect of our application through the use of a wireframe prototyping application. This would allow us to create a prototype of the application within ReactNative that could eventually be imported directly into our working application. We chose to build the user interface in a wireframe application first so that we could create a high level design of how the user would be prompted before we focused on smaller details. This approach would allow us to ensure that the basic functions are built in before accessibility aspects are worked in.

We were successful in building and launching the neural network. We have yet to meet with our project sponsor to fully label burns so that the model can be trained by professional medical judgement. As for as our goal for developing the user interface, access to BuilderX, a design interface that seamlessly translates to ReactNative, was purchased and we have begun learning how to use and create a visual prototype for our application. We are also in the process of sketching out the basic design and appearance of our application to begin building in BuilderX. Previously, we had been doing research on design guidelines as advised by Android's online developer's resource and are taking into consideration these standards when designing our own application.

Progress Since Last Time:

We starting learning the software to create our user interface called Builder. We created another flowchart to be digitized with this software. Currently, our flowchart is very broad and will be used to create how the application moves from slide to slide. This flowchart organizes when and where information can be inputted by medical professionals as well as how the output from the neural net is shown. We are aiming to have this digitized by the coming weeks to show our advisor.

The neural net model is built as well as the trainer for the network. The trainer works well and can run with any number of input images. It uses the tensorflow Adam Optimizer to try to minimize the cost (the mean of the cross entropy between the last dense layer and the softmax layer) by changing the weights and biases in each of the layers. These weights and biases are then saved every epoch (every time the program runs through all of the pictures in batches of 20). The weights and biases can then be accessed later in our predictor function that we are currently working on.

Challenges Faced:

A challenge that we faced was that we had ~100 images of burns of varying sizes but our neural network implementation would only operate on images of specific dimensions (50x50 pixels). To train the neural network, we would have needed to manually slice out 50x50 pixel subimages from the provided burn images and label them one-by-one accordingly, which would have been extremely time consuming and prone to error. To solve this issue, we developed a graphical software that allows the user to 'paint' the screen with the specific label type (burned,

healthy, or background) and automates the sorting of these individual images into their appropriately labeled folders. This solution solved the original challenge and we have been able to quickly classify nearly 3000 subimages. We have also implemented a feature to label images specifically for burn degree. This will enable us to train our neural network to identify regions of varying burn severity on a burn victim's body.

The Builder software is only available on Mac which not everyone in our group has. So, we are working on one person's computer.

Next Steps/Moving Forward:

In the next weeks, we will digitize the broad application flow chart, meet with Dr. Kumar to see how he likes the flow of the user interface, and begin to increase the details in the digitized version. This is a crucial step within our project, as the application front end represents the part of the project which the physicians will be directly interfacing with. As a result we will aim to have this front end be as easy to understand as possible and create it in such a manner so that it does not disrupt the current flow of care within the care centers.

We aim to have several branching pathways built into our application, to allow for easy updates and monitoring of any patient information within our application. We will begin modelling our initial application within BuilderX, as this platform allows us to create an application that will interface with react native code, which our neural net and camera applications are being constructed in. We will begin to familiarize ourselves with the construction of applications in this software and we look forward to creating a useful and easy to understand customer interface that will integrate the other areas of our project in a seamless manner. We will also continue to familiarize ourselves with the current protocols of the Burn ICU and lower referring centers in order to determine what aspects of our application easily fit into existing protocols, and what aspects we will need to change within the future.

At the last meeting with Dr. Kumar in which we showcased the image labelling software and received instruction on how to label images for burn degree, Dr. Kumar asked about plans for a prototype neural network. This neural network implementation will identify regions of an image as either burned skin, healthy skin, or background, and display that classification result as an overlay on the image. The classification accuracy of the neural network can then be easily assessed by burn experts before we incorporate the total body surface area (TBSA) calculation algorithm. Our goal is to produce this prototype before our next meeting with Dr. Kumar and before our next written progress report.

Over the next week, the predictor function should be up and running so that it will predict the class of any 50x50 pixel image we feed into it. This will allow us to split any image we take into 50x50 pixel subimages and feed them into the network to classify them. By splitting the images up into 50x50 pixel parts we are able to accurately determine the total amount of skin that is burned within the picture with sufficient accuracy. We also need to label more pictures to feed into the training function in order to optimize the network and train on a more diverse image set. We want our application to be able to recognize burns across a plethora of skin, however in order to do so we need a large number of various skin types both with and without burns in order to train our neural network. We have had some difficulty obtaining images from the VUMC

Burn ICU of patients with different skin tones, however we hope that a continued search through their records as well as a search of available resources will return more varied burn images.