Skin Lesion Classifier

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RFC: Google Doc
VM Address: vcm-1840.vm.duke.edu:5000 (see readme/RFC for API endpoint information)

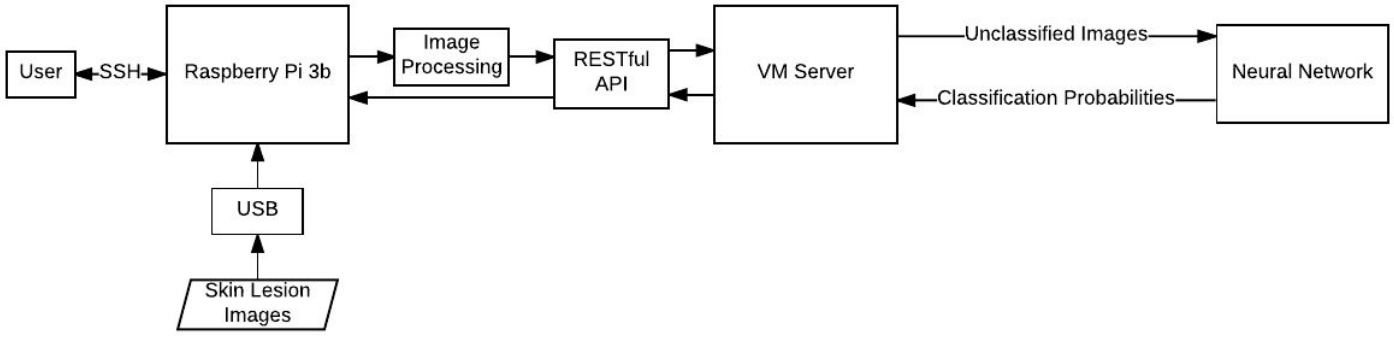
Introduction & Background

If detected early, melanomas are readily treatable and patients who undergo treatment have high survival rates. Therefore, the Cloud-Based Lesion Classifier service seeks to allow doctors to quickly and cheaply assess melanoma risk level, increasing early detections rates. To do this, the service will use a cloud-based neural network to leverage thousands of lesion classifications confirmed by excisional biopsy, allowing for accurate classifications to inform doctors' decisions regarding further testing. By utilizing big data, this service will help eliminate the subjective nature of visual melanoma inspection, providing consistent and accurate assessments of risk.

The Cloud-Based Lesion Classifier will analyze skin lesion images from any internet connected client to determine the presence of melanoma. The Raspberry Pi client will receive images via its USB port, preprocess them, then send the data via a RESTful API request for classification by a neural network, after which the service will return the cancer risk level. Additionally, users will be allowed to submit skin lesions with known classifications to be stored in a database and used to train the neural network.

Design

This service accepts JPEG and PNG lesion images via the USB port of a local machine or Raspberry Pi client. After specifying the USB drive letter, this service will extract all compatible images found in the main directory of the drive and submit them for classification. The images are then converted to a base-64 encoded string and sent in JSON format as an API request to our VM server, which converts the images to 3D arrays for processing by the neural network. The classification is then returned to the client in JSON format, converted and parsed, then appended to an output file classification.out containing the image name, classification, certainty, and date. Our final workflow is pictured in the image below.



Performance & Evaluation

To evaluate our performance, our service was tested with 150 classified images from the International Skin Imaging Collaboration (ISIC) project. The results are summarized in the table below.

Sensitivity	57.8%
Specificity	68.8%
Accuracy	66.0%
Classification time per image	3.34 s