Husky Compact Reflection: Think Creatively and Critically
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In connection with the demonstration “Husky Masquerade”
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Face detection is the process where machines identify faces within an image or visual field. Face detection is used in analyzing emotions, and even in social networking applications, such as Snapchat. The underlying mechanism of face detection is to locate key landmarks on a person’s face. These landmarks are distributed across the face, over the eyebrows, eyes, nose, lips, and jawline. Face detection is a subset of face recognition. Although the two processes are similar, there is a distinction. Face recognition requires the machine to record the faces detected in its memory, and access the faces stored when required. Face detection enables machines to understand the world better, and interact with humans effectively. The goal is to detect faces using a webcam, find the facial landmarks of the detected faces, and overlay customized images relative to the facial landmarks. Machines need to be taught to detect faces. Faces can be of a wide variety. For instance, there are multiple types of jawlines: triangle, oval, round, oblong, diamond, square, and heart. The landmarks for each of these differ. Hence, it is crucial to teach the program to identify the different types of jawlines. The program is provided a data model, which specifies different combinations of facial landmark positions. The machine is then able to compare the objects seen in its visual field to the data model. The accuracy of face detection depends on how detailed the data model is. Once the machine recognizes the landmarks, it places image overlays across the visual display or mutates the visual display. These images can be stationary across the visual field, or mobile relative to the facial landmarks.

The first resources to learn about face detection were books on Computer Vision. The bibliographies at the ends of chapters, pointed out various sources, such as ACM and IEEE journal articles. Other peer-reviewed articles found on Google Scholar, as well as related articles from these articles, opened up a wealth of information that aided in the progress of the project. Researching authors, led to their websites or blogs. These contained specifications of the various projects they have explored. The authors’ blogs gave valuable suggestions and guidance on how to go about the project. This saved a lot of time, especially when it came to setting up the environment to implement the project, and even when it came to troubleshooting errors in the implementation. Seeing the projects done by these authors, as well as seeing the ratings and reviews from others interested in their work, indicated that they are knowledgeable in the area of Computer Vision. Reaching out to the authors on particular issues and receiving feedback from them was helpful.

The programs created for this project closely resemble Snapchat or Instagram filters, except that it is not compatible with smartphones. The fundamental concepts, such as face detection, are the same. The project started by exploring the fundamental concepts of Computer Vision. For example, when a scene is observed in a webcam, it contains a combination of three colors: red, blue, and green. This color scheme is standard across all cameras. However, the combination of the three colors can be manipulated so that the scene displays the new combination. The visual scene can also be manipulated so that the scene looks more like a cartoon, rather than its original. Instead of reinventing the wheel, and digressing from the real problem, using the tools provided by OpenCV facilitated the creation of the filters. The correlation between the photo-editing software, Adobe Photoshop and OpenCV can

essentially perform the same tasks when it comes to image processing. However, Adobe Photoshop provides a high-level version of the tools that are easier to use than OpenCV. The filters were exercised on images during the early stages of the project. Later, filters were designed to address visual scenes in real-time; as in Snapchat and Instagram. The overlay images for the filters have been designed from scratch.

The programs built for this project are capable of detecting faces using a webcam, finding the facial landmarks of the detected faces, and overlaying customized images relative to the facial landmarks. Before the programs were created, existing software, toolboxes, and libraries were surveyed. The survey considered the cost of setting up the environment, the time required to learn how to program in the environment, and how well documented the software was. Using these criteria, the programming environment was narrowed down to MATLAB and OpenCV. Initially, MATLAB was considered, since it has an image processing toolbox. However, it was not built solely for image processing, so its toolbox lacks some important tools. OpenCV, on the other hand, is a library built specifically for Computer Vision. Moreover, it is an open-source library, which means that contributors have heavily documented the contents of the library and maintained it over time. Face detections implemented in this project are simplified, since it is implemented in OpenCV. Program execution is also faster than a similar program implemented in MATLAB. Since OpenCV has advanced built-in face-detection tools, the accuracy of face detections is close to perfect. Moreover, face detections and filtering occur in real time, just as in Snapchat or Instagram. The project's programs closely resemble Snapchat and Instagram filters. The limitation of the programs built for this project is that they have not been optimized for smartphones; the programs work only on a laptop or a smaller computer, such as the Raspberry Pi. Hence, the programs are not widely accessible to the general public.