SpotLight

- Making Conversations stay Focused

Project report submitted to the Amrita Vishwa Vidyapeetham in partialfulfilment of the requirement for the Degree of

BACHELOR of TECHNOLOGY

in

COMPUTER SCIENCE AND ENGINEERING

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MAY 2021

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BONAFIDE CERTIFICATE

This is to certify that the project report entitled **"SpotLight"** submitted by **Ch. Mounish (AM.EN.U4CSE18113), Kallam Subhash Reddy (AM.EN.U4CSE18126), Likith Mothukuri (AM.EN.U4CSE18136) and Vijay Tanmay Tatikonda (AM.EN.U4CSE18155)**, in partial fulfillment of the requirements for the award of Degree of Bache-lor of Technology in Computer Science and Engineering from Amrita Vishwa Vidyapeetham, is a bonafide record of the work carried out by them under my guidance and supervision at Amrita School of Engineering, Amritapuri during Semester 8 of the academic year 2020-2021.

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DECLARATION

We, **Ch. Mounish (AM.EN.U4CSE18113), Kallam Subhash Reddy (AM.EN.U4CSE18126), Likith Mothukuri (AM.EN.U4CSE18136) and Vijay Tanmay Tatikonda (AM.EN.U4CSE18155)**, hereby declare that this project entitled **"SpotLight"** is a record of the original work done by us under the guidance of **Vinitha J Panicker**, Dept. of Computer Science and Engineering, Amrita Vishwa Vidyapeetham, that this work has not formed the basis for any degree/diploma/associationship/fellowship or similar awards to any candidate in any university to the best of our knowledge.

Place : Amritapuri
Date : 22 Dec 2021

Signature of the student

Signature of the Project Guide

Acknowledgements

Abstract

We aim to intelligently adjust the field-of-view (FOV) of the available camera by cropping into the video frames. Taking advantage of the wide angle prospect, We use the available spanning space to adjust, tune and crop into areas of interest without physically moving the device.

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Chapter 1

Introduction

1. Section A

The idea behind is to use the wide-angle front camera with applied machine learning to keep the person/people in frame as they move, allowing a person to go hands-free or move about during a video call or when recording oneself in ease.

The operation beneath is to use a custom model built for adjusting crop factor for the sensor along with Face-recognition and Object tracking to allow focus on both people as well as objects for consistent and clear communication.

2. Section B

The hypothesis being that users can stay more confident and needn't worry about whether focus or positioning in the capture frame of the video to a higher degree without much setup and time needed.

Chapter 2

Problem Definition

Covid-19 hit the world strong in 2020, causing lockdown's spanning almost a year. This consequently lead to the world moving online. From Schools to College to Office works, Everything was flexibly done over the Video and Audio Interfaces.

There is nothing wrong with the video capabilities until more and more people started multi-tasking where positioning of camera turned into a problem. Moving around while in a video call can cause the meeting to feel disconnected.

We aim to alleviate this trouble by focusing on the subject and framing around the subject to make it seem that the subject is always at the center of the frame. This makes the conversation much more focused and connected.

Chapter 3 Related

Work

- Video Object detection with a convolutional regression tracker: *Link*
- Deep mutual learning for visual object tracking: *Link*
- AMD Fidelity FX Super-Resolution: *Link*
- DNN for low-cost Eye Tracking: *Link*

Chapter 4

Requirements

4.1 Software:

- Flask
- MediaPipe
- OpenCV
- Python
- Dlib

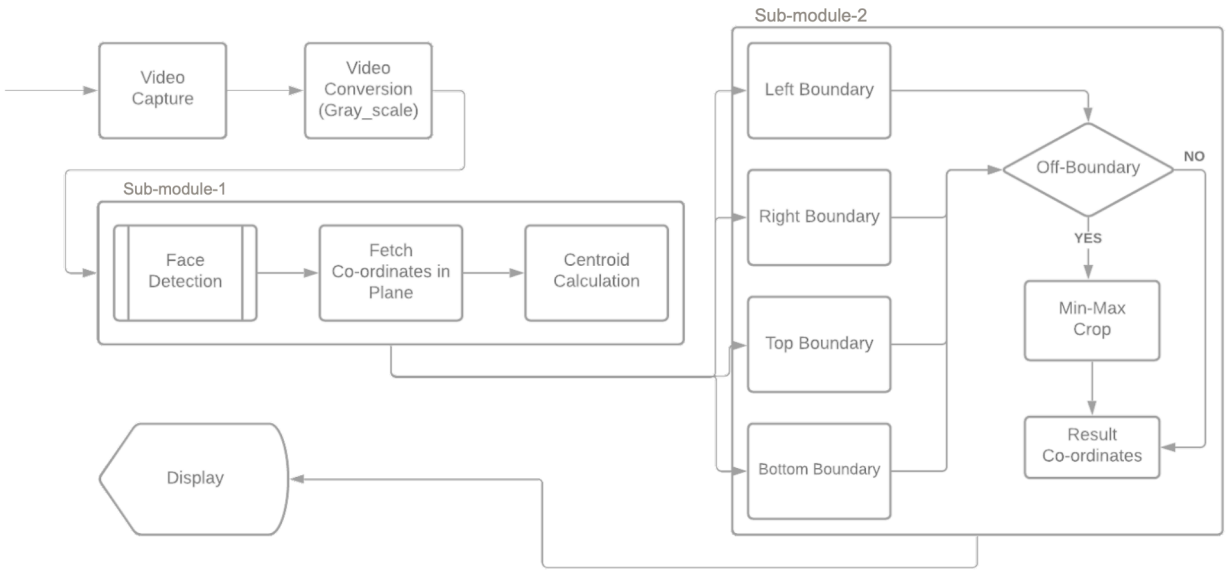
4.2 Hardware:

- Webcam
- PC running Windows, Mac or Linux
- Light Source
- Discrete GPU (To accelerate MediaPipe Processing)

Chapter 5

Proposed System

Block Diagram



Algorithm implemented

1. Detect the face in the frame and calculate the two bounding box coordinates.
2. Calculate the centroid of the bounding box.
3. Span the spotlight frame across the full sized input.
4. Limit the spotlight frame boundaries such that it does not go over the boundaries of the original frame.
5. Crop into the spotlight frame and render the frame.

Chapter 6

Result and Analysis

We were able to successfully track and keep focus on a subject under ideal lighting conditions. Thus, making conversations stay focused and streamlined towards users for robust experience.

We are certainly facing some challenges with the following;

- Under poor lighting conditions, The tracking is hindered leading to missed tracking in some frames resulting in an un-desired output.
- The loss of resolution due to extensive cropping of 1:4 ratio, resulting in around 75% loss of quality.
- The frame-rate can become choppy when handling multiple subjects within the same frame.

Chapter 7

Conclusion

We have developed a satisfactory prototype with the intended functionality. The limitations in this version sure are an issue one cannot ignore.

We aim to iron out these issues with each layer of functionality implemented with execution over the planned timeline, reaching milestones with each version of release.

References

[1] Video object detection with a convolutional regression tracker - *Link*

[2] Three-step action search networks with deep Q-learning for real-time object tracking - *Link*

[3] Deep Neural Networks for Low-Cost Eye Tracking - *Link*

Appendix A

Source code

Link to Source Code

Link to GitHub repository attached