

Stereoscopic 3D Vision: Problem Statement

Erin Sullens, John Miller, Sam Schultz

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Sponsor: Kevin McGrath

Abstract

Stereoscopic 3D Vision presents a question. What if we were able to record an entire road trip and be able to view it in 3D later on? What we intend to do with this project is take footage of road trips that are taken by two individual cameras mounted on the front of a vehicle. With the two separate video files we will be able to correlate the feeds and combine the frames into a stereoscopic image using GPS timestamps from the videos, and be able to view the resulting video in a VR headset. There are many ways in which this could be useful, from indoor bike training, to just being able to relive your favorite road trip in virtual reality.

Problem Statement

In general terms, the problem we are trying to solve is turning two separate video streams from a road trip into a stereoscopic three dimensional video. The two separate video streams come from two cameras mounted on either a fixed or mobile location, at a known height and distance apart. The cameras we are using store meta information for each frame they capture and stores it in a binary blob. Decoding the binary blob is a key step that needs to be solved in order to do any other development of the project.

We are initially focusing on applying this technology to vehicles, allowing our client to record his drives, turn them into 3D video, and replay them using some device that can handle that video format. These formats include but are not limited to a virtual reality headset and 3D TV.

Problem Solution:

The first step in our solution consists of creating a mount that is capable of securely holding two portable cameras. The two cameras will have the capability of tracking GPS data of the video. The GPS file will be parsed into a workable format and will be used to correlate each video frame into one video feed. OpenCV offers the framework for most if not all of the technical problems presented, including video stabilization and creating a stereoscopic video feed. Once the two video feeds have been successfully integrated into one stereoscopic feed it will be formatted to be played on a virtual reality headset.

Since it is unknown if we can totally stabilize the videos taken from a trip by car, we might have to start with something more simple. One idea is to take a stationary video with the two cameras, and convert that into 3D format. From there, we can mount the two cameras to a bicycle and move it in a straight line on smooth ground so we can have some footage that is relatively smooth. If that works out, we can then move to more shaky means of video capture, like mounting the cameras on a truck and getting some road or off-road footage.

We also are hoping that we can work with the tech company, Garmin, because the cameras that we will most likely use will be from them. If they get on board, we might be able to have access to technology and knowledge that could help in situations like parsing the binary blobs that video files provide us with.

How Does the Solution Meet Needs of the Problem?

By using meta information like timestamps and GPS data that the camera stores while recording, we can correlate the video frames from each camera. Creating a stereoscopic video requires the two videos be in sync, and with the data provided we should be able to do achieve actual stereoscopic video.

By using OpenCV we gain access to tools which will help us implement our solution in a timely manner. If we attempted to create our own tools to handle the video transformations we would most likely not finish the project by Expo. In addition, OpenCV offers many tools which will help us not only create the video, but improve the quality of it. Video stabilization and field of vision interpolation are two of these tools.

How will we Know When we Are Done?

The project will be considered complete when the team is able to create a new video from a mobile source, transform it into stereoscopic 3D format, and view it in at least one 3D viewing device. In addition the team will have the necessary materials to present the completed project at Expo. At minimum these include an elevator speech and poster containing information about the project. Ideally this also includes a demo of the project and some 3D viewing device that people can use.

What will we show at Expo?

At Expo, we plan to show the process of our project on the poster. This could include snapshots of the videos and what the resulting image looks like in 3D, pictures of how we mounted the cameras on different vehicles, and a non-technical explanation of how we achieved our end result.

What we really want to show at Expo is a VR headset that people can try on and view 3D videos. Depending on what we are able to get working, it could range from showing road trips to drone videos. If we are able to explore our stretch goals and the real-time rendering of stereoscopic videos works and isn't very time consuming, it would be pretty impressive to be able to record footage on a bike at Expo and be able to show people how the whole process really works.

Stretch Goals:

If we are able to successfully implement our solution in the estimated timeframe we have some options for additional features we can implement. We can adapt the camera mount to attach to a drone in order to get a new frame of reference for videos. Another option we can explore is real-time rendering of the stereoscopic feed on an embedded device. This would possibly allow us to have more demo options at Expo.