Rip Current Detection using Optical Flow

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Abstract—Rip currents are narrow currents of fast moving water that are strongest near the beach. These type of currents are dangerous for swimmers. Many people get stuck in rip currents and are responsible for majority of the lifeguard rescues near beaches [1]. This project talks about using optical flow to detect rip currents using a mobile device.

Index Terms—Computer vision, optical flow, rip currents and dynamic texture.

1 INTRODUCTION

The rip currents are very fast moving narrow channels, which if caught in can cause a person to drown. The currents pull a person towards the water body. Instinctively, people try to swim against the current, but it results in exhaustion and eventually drowning.

According to University of Delaware Sea Grant College, there are four ways to identify rip currents [2]. They are as follows:

1) A channel of churning, choppy water;
2) A line of sea foam, seaweed, or debris moving steadily seaward;
3) Different colored water beyond the surf zone; and
4) A break in the incoming wave pattern as waves roll into shore.

The rip currents are caused along the coastline where break waters occur. Certain circulation cells are formed when the waves break strong at some regions and weakly in others. These generally occur at beaches with sand bars and channel system nearby. This water flows back towards off-shore following a narrow path, forming a rip current [3].

2 MOTIVATION

According to a study by United States LifeSaving Association, the annual number of deaths caused by rip current exceeds 100. There are about 80% of the rescues due to people almost drowning in rip currents [4]. An mobile application that can detect rip currents in oceans, can help people identify these currents. Thus help avoid such areas and saving many lives.

3 RELATED WORK

Optical flow is easily performed on objects that are rigid and non-dynamic texture. For this project, optical flow is to be performed on water which is non-rigid and does not have a constant texture. The first step to achieve the objective is to recognize dynamic textures. Saisan et ál came up with a solution to recognize and classify dynamic texture is uniquely represented[5].

Based on the above paper, Vidal et ál wrote a paper which performed optical flow on dynamic texture using Dynamic Texture Constancy Constraint [6].

4 PROPOSED RESEARCH DIRECTIONS

There are not many video evidences of rip currents available, but there are many images available. The images can used to identify a way to segment, the area of interest to operate optical flow on. The rip currents usually are characterized by being more foamy than the neighboring waves.

Fig 1. Formation of Rip Currents [3]

This project uses optical flow on dynamic textures to find the motion of the water near the shore leading to the detection of rip currents.

Fig 2. Example of a Rip Current [7]

The above image shows a small rip current being formed near the beach. The rip current looks foamy in comparison to the water surrounding it, differing much in contrast.

The dynamic texture recognition can be used on this area of interest, on which optical flow can be performed. Depending on the flow of the water suggested by the optical flow algorithm. The rip current can thus be identified by the end of the process.
REFERENCES