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TECHNOLOGY

CARLOW

At the heart of South Leinster

Functional Specification

What's it like Outside?

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Introduction

Can a computer accurately identify what the weather's like outside by simply analysing an image of outside? This project researches if this is possible by implementing the computer vision techniques from the research report. The project code will need OpenCV installed on the intended machine for it to run.

The purpose of this document is to explain what the project can be used for and by who. It also details how the techniques were applied and the steps taken through each iteration of the project.

What is the application supposed to be?

The main purpose of this application is to research how far the the quality in computer vision techniques has come. Could these techniques be used to effectively identify the weather condition by analysing an image of outside?

This project is a research based project that tries to find a solution to the specification.

What is the application supposed to do?

The application will be able to read in an image, extract regions of interest (the sky), and analyse the extracted region (colour detection).

This project involves the following steps:

1. Read in an image to the system. This project uses a simple folder with over 50 random images for testing purposes.
2. The image gets segmented by using a combination of blurring and edge detection techniques to locate the horizon in the image. If the horizon is found, a floodfill algorithm is applied above and below the horizon a number of times to remove unwanted information.
3. If successful, the image will be a binary image, where the sky region is identified by the colour white. Then the image gets masked with the original image to extract the sky region.
4. Now the sky region is obtained, analysis can begin. Colour segmentation is used to identify the amount of blue pixels in the sky. Based on the percentage of blue pixels present, assumptions are made to describe the weather condition.
5. Colour segmentation is also used to obtain the darker clouds in the overcast images, just to display more specific results. Whereas before, if the blue

percentage was very low, it was assumed that the weather is overcast. This is approach allows us to assume that the greater the percentage of darker clouds, the stormier the sky will be.

Who is going to be using this application?

This project would be very useful to those interested in computer vision, specifically the area of image segmentation and image analysis. Or those interested in understanding how we can gather information from images without using the neural network approach of comparing images with a large dataset of images.

Project Schedule

First Iteration

The first iteration involved researching computer vision techniques and how they could be implemented into the project. Started of by using GIMP to try to manipulate the image in different ways, such as applying edge detection to an image, to try and get a grasp of how vision techniques are used.

Finally came across a very helpful website that introduced me to all the basics of computer vision techniques using OpenCV and the Python programming language.

From there I purchased an OpenCV tutorial starter package and began installing opencv onto my machine to test out all the different tutorials that came with the starter pack. It involved all the basics from blurring, thresholding, edge detection, etc. This enabled to get a grasp on how the techniques work and which of them I could implement into my project.

The first step in starting the testing was by applying a thresholding method on images to try and extract the sky region (background) from the ground (foreground). This approach was not very successful on a wide range of images so a different approach was needed.

Second Iteration

The plan for the second iteration was to continue trying to extract the sky region from the image. So the use of edge detection was used to locate the horizon, with as much unwanted noise and edges removed as possible. This provided to be a more effective approach over thresholding.

Once the sky region was extracted, the process of identifying the blue colour pixels of the sky region began. This was very time consuming as it involved testing out a range of values to find the best pixel value for the lightest blue pixels and the darkest blue pixel in the sky.

Third Iteration

The process of identifying the blue sky continued on into the third iteration. The previous approach used OpenCV's BGR format to find the best ranges for the colour blue. Again, a new approach was tested. This involved using HSV colour values for finding the colour blue in the sky regions. It was immediately easier to find the best values to use. A simple trackbar program was created to aid finding the HSV values. Once colour analysis became easy to use, and quick to implement, the rest of the project became much easier to finish. Blue and grey colours were analysed and final assumptions were based based on the amount the identified colours were present in the sky region of an image.

After all the testing was completed, the last stage of the project was to finish all the documents necessary.