Crash Prevention App

EC601 - Product Design

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Sprint 2 review

- Through the open source, we successfully got the depth map.
- After we got the depth map, we introduced some modules to get confidence map.
- Set up a demo application to get the space image by Apple ARKit.

What we do on sprint 3

- Colorize the resulting image
- Mark the distance on the image by displaying them in different colors.
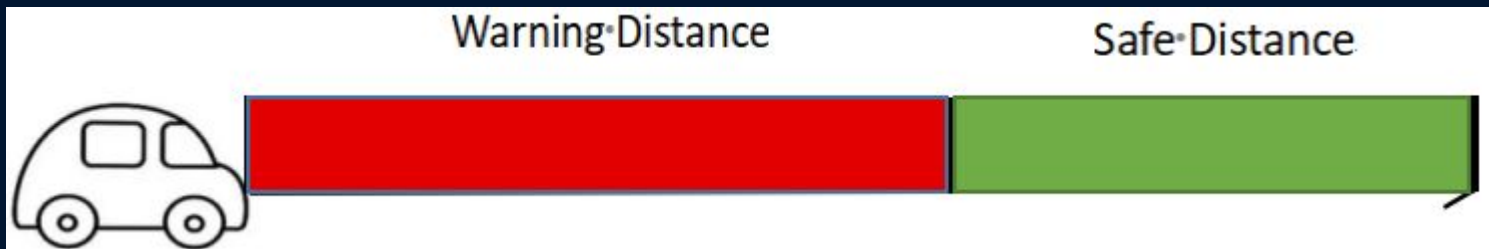- Analysis: Binary image *vs* Color image

Color image (Why use color image?)

- The human eye is more recognizable to colors with high contrast.(Red and green)
- Safe distance: Green because red and green are complementary colors, and the two complementary colors are the most contrasting.
- Warning distance：Red because red light has a long wavelength, penetrates air well, and is more noticeable than other color.

CIE Phototopic Response Curve
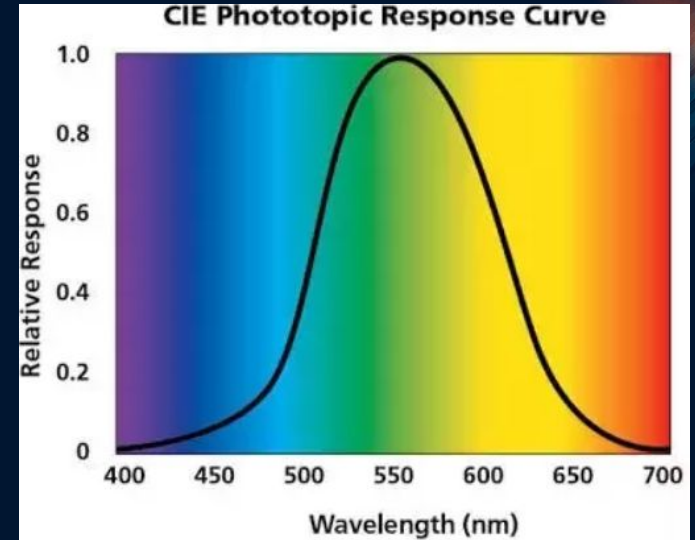
Distance with color

- In the test case, the speed of the toy car is set to 10 m/s.
- the measurement distance is 0-10 meters, and the dangerous distance is determined to be 6 meters.
- Under the premise of no accident, the maximum deceleration of the car is 8 m/(s^2), so we need to allow enough time for the driver or artificial intelligence to respond to the road conditions.

Warning Distance   Safe Distance

Color image vs Binary image

- In the dark, when a human is driving, the red-green method of showing the distance in front of the car will become insensitive. Because the human eye cannot respond quickly to red and green in a dark environment.
- But in dark environments, the human eye can respond quickly to smoothly changes in brightness.
- So binary images can replace red and green images in dark environments (night, tunnels).

Some code of Matlab

```matlab
i=imread('linna.jpg');

i=rgb2gray(i);

k=16;

H=histeq(i,k);

figure(1); subplot(2,2,1);imshow(i,[]);

subplot(2,2,2);imshow(H,[]);hold on

subplot(2,2,3);hist(double(i),16);

subplot(2,2,4),hist(double(H),16);
```
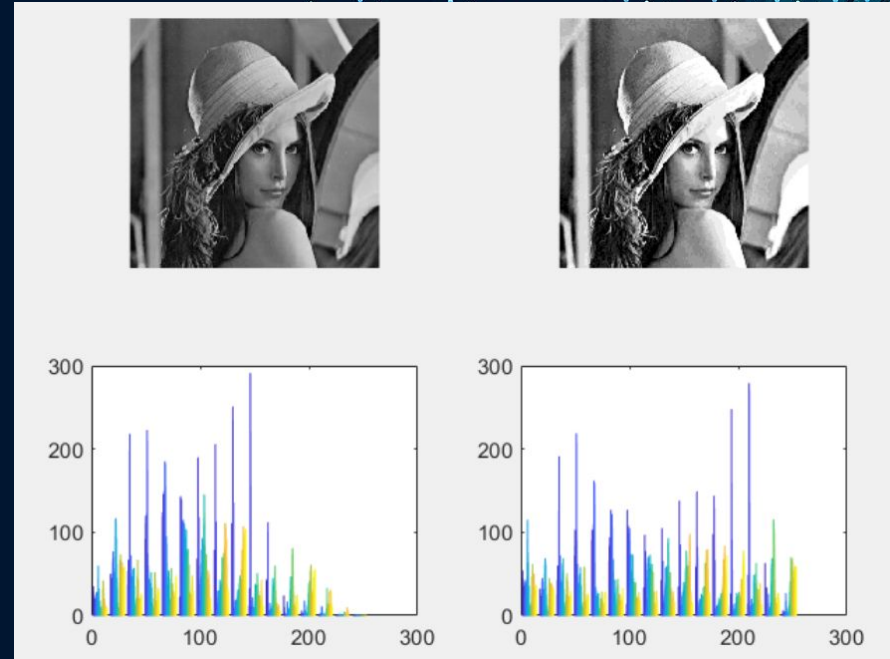
Achievements

- Successfully colorizing the depth map gotten in sprint 2.
- We test the imaging quality of the binary image and the color image, and the applicable scenes of the two images were judged from the results.
- In the distance prediction interval, different distances are given different colors, thereby realizing the judgment of the distance between the object and the measurement point through different colors.

What did not work

- In the case of long-distance measurement, there are still inaccurate results.
- Colors that show distance must have high monochromaticity, but we don't currently find a way to achieve that.
- Due to the dark environment, the binary image produces a lot of noise, we need some low-pass filters to reduce the noise and improve the signal-to-noise ratio.
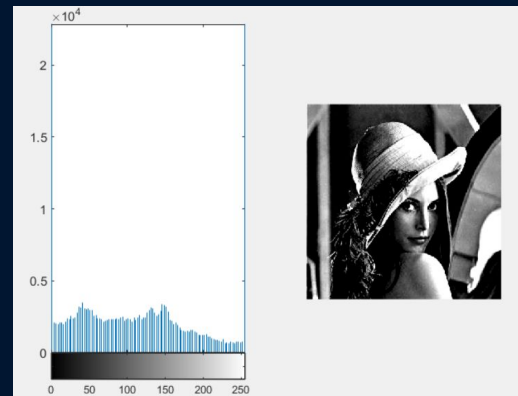
Sprint 4 Goals

- Demo an app combine distance and alert
- Reduce the time of calculation for the distance in front of car.
- Find ways for ARKit to measure longer distances.

RESOURCES

- [Smart Traffic Management System | Smart Traffic system | FaststreamTech](#)
- [ARKit 6 - Augmented Reality - Apple Developer](#)
- [How a Laser Rangefinder Works (Explained!) | Outdoor Empire](#)
- [Artificial Intelligence in Tesla Vehicles | Xaltius](#)
- [What is Automatic Emergency Braking (AEB)? - Basic Guide (caradas.com)](#)
- [Xcode 14 Overview - Apple Developer](#)
- https://github.com/TokyoYoshida/ExampleOfiOSLiDAR
- https://developer.apple.com/documentation/arkit/arframe/3566299-scenedepth
- https://www.wwdcnotes.com/notes/wwdc20/10611/
- [Why does the human eye see more shades of green than any other colour? - Quora](#)
- [MATLAB | Converting a Grayscale Image to Binary Image using Thresholding - Image-processing (topitanswers.com)](#)

Thanks

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