A screenshot of a cell phone

Description automatically generated

EE5731 Visual Computing

Assignment 2: Depth Estimation From Stereo and Video

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**Part 1: Noise Removal**

Original Image:

A close up of text on a white surface

Description automatically generated

Noise removal images with different values of lambda:

A picture containing text

Description automatically generatedA picture containing text

Description automatically generatedLambda = 1 Lambda = 5

A picture containing text

Description automatically generatedText

Description automatically generated

Lambda = 10 Lambda = 50

A picture containing text

Description automatically generatedText

Description automatically generated

Lambda = 100 Lambda = 500

Text

Description automatically generatedA picture containing text

Description automatically generated

Lambda = 1000 Lambda = 1500

As we can see that when the value of lambda increases, more and more blue pixel noise will be converted to surrounding yellow pixel. The denoising effect becomes stronger and stronger. However, when the lambda increases to a too large value, the image becomes more blur.

The best result is as below when ***lambda = 100***:

A picture containing text

Description automatically generated

**Part 2: Depth from Rectified Stereo Images**

A pair of rectified images:

A picture containing table, sitting, food, small

Description automatically generatedA picture containing table, food, sitting, building

Description automatically generated

Depth map using different values of lambda:

A picture containing nature, rain, outdoor, covered

Description automatically generatedA picture containing nature, rain, outdoor, flock

Description automatically generated

Lambda = 0.0003 Lambda = 0.0006

A picture containing outdoor, snow, ship, covered

Description automatically generatedA picture containing snow, covered, skiing, group

Description automatically generated

Lambda = 0.0009 Lambda = 0.003

A picture containing map

Description automatically generatedA picture containing light, ship, dark, traffic

Description automatically generated

Lambda = 0.006 Lambda = 0.009

A picture containing transport

Description automatically generatedIcon

Description automatically generated

Lambda = 0.03 Lambda = 0.06

Icon

Description automatically generated

Lambda = 0.09

As we can see that when the value of lambda increases, the depth map becomes more smooth. When the value increases too large, the depth map becomes more blur.

The best result is as below when ***lambda = 0.006***:

A picture containing map

Description automatically generated

**Part 3: Depth from Stereo**

Original a pair of non-rectified images:

A sign on the side of a road next to a tree

Description automatically generatedA sign on the side of a road next to a tree

Description automatically generated

According to the paper, set the parameters as below:

disparity = 0.0001:0.0002:0.01 =

[0.0001 0.0003 0.0005 0.0007 0.0009 0.0011 0.0013 0.0015 0.0017 0.0019 0.0021 0.0023 0.0025 0.0027 0.0029 0.0031 0.0033 0.0035 0.0037 0.0039 0.0041 0.0043 0.0045 0.0047 0.0049 0.0051 0.0053 0.0055 0.0057 0.0059 0.0061 0.0063 0.0065 0.0067 0.0069 0.0071 0.0073 0.0075 0.0077 0.0079 0.0081 0.0083 0.0085 0.0087 0.0089 0.0091 0.0093 0.0095 0.0097 0.0099]

ωs = 20 / (dmax – dmin)

η = 0.05 \* (dmax – dmin)

ε = 50

σ = 10

The best depth map result is as below:

A picture containing light, traffic, lit, toy

Description automatically generated**Part 4: Depth from Video – Basic**

Set the parameters same as part 3 and set the fps (frame per second) as 5:

disparity = 0.0001:0.0002:0.01 =

[0.0001 0.0003 0.0005 0.0007 0.0009 0.0011 0.0013 0.0015 0.0017 0.0019 0.0021 0.0023 0.0025 0.0027 0.0029 0.0031 0.0033 0.0035 0.0037 0.0039 0.0041 0.0043 0.0045 0.0047 0.0049 0.0051 0.0053 0.0055 0.0057 0.0059 0.0061 0.0063 0.0065 0.0067 0.0069 0.0071 0.0073 0.0075 0.0077 0.0079 0.0081 0.0083 0.0085 0.0087 0.0089 0.0091 0.0093 0.0095 0.0097 0.0099]

ωs = 20 / (dmax – dmin)

η = 0.05 \* (dmax – dmin)

ε = 50

σ = 10

fps = 5

Some example depth map:

A picture containing map

Description automatically generatedA picture containing light, photo, traffic, looking

Description automatically generated

A picture containing text

Description automatically generatedA picture containing text

Description automatically generated

A picture containing diagram

Description automatically generatedA picture containing map

Description automatically generated

**Reference:**

Function EDGE4CONNECTED, (c) 2008 Michael Rubinstein, WDI R&D and IDC