Depth Image Region Segmentation

Jackson Spell and **Micah Brown**
{jaspell,msbrown}@davidson.edu
Davidson College
Davidson, NC 28035
U.S.A.

Abstract

Segmentation algorithms separate an image into unique regions determined by characteristics of the pixels within those regions. Image segmentation has applications in Artificial Intelligence, including computer vision, 3D modeling, and robotics. We use two different segmentation algorithms to separate a depth image, which has distance information encoded into each pixel rather than conventional RGB values. Whereas color images are commonly segmented into regions of similar color or luminosity, we segment the depth image into cohesive surfaces. We segment depth images using gradient difference and Laplacian edge detection. When combined together, these two methods offer a chance to reconstruct three dimensional objects from depth data.

1 Introduction

Image processing is a vital component of computer vision and artificial intelligence. Within image processing, image segmentation continues to be a focus of research as machines are expected to be able to have similar visual abilities as humans. Image segmentation divides an image into regions of similar characteristics, which ultimately can lead to object recognition.

Depth images contain information about the distance a point in space is to the camera eye. Whereas traditional RGB images contain a matrix of pixels, each containing a red, green, and blue value, a depth image only contains a matrix of depth values. Depth images can be visually rendered as black and white images, where a point of maximum distance is represented as white and a point of minimum distance is represented as black. Accurate depth images were hard to construct until the invention of modern technologies. Notably, the Xbox Kinect sensor has the ability to simultaneously record depth images and color images, providing researchers easy access to rich depth data.

There are two main approaches for segmenting an image: edge-based segmentation and region-based segmentation (Russell and Norvig 2003).

In this section, you should introduce the reader to the problem you are attempting to solve. For example, for the first project: describe the 15-puzzle, and why it's interesting as an A.I. problem. You should also cite and briefly describe other related papers that have tackled this problem in the past — things that came up during the course of your research. In the AAAI style, citations look like (Russell and Norvig 2003) (see the comments in the source file `intro.tex` to see how this citation was produced). Conclude by summarizing how the remainder of the paper is organized.

Overall, the aim in this section is context-setting: what is the big-picture surrounding the problem you are tackling here?

2 Background

Describe any background information that the reader would need to know to understand your work. You do not have to explain algorithms or ideas that we have seen in class. Rather, use this section to describe techniques that you found elsewhere in the course of your research, that you have decided to bring to bear on the problem at hand. Don't go overboard here — if what you're doing is quite detailed, it's often more helpful to give a sketch of the big ideas of the approaches that you will be using. You can then say something like "the reader is referred to X for a more in-depth description of...", and include a citation.

3 Experiments

In this section, you should describe your experimental setup. What were the questions you were trying to answer? What was the experimental setup (number of trials, parameter settings, etc.)? What were you measuring? You should justify these choices when necessary. The accepted wisdom is that there should be enough detail in this section that I could reproduce your work *exactly* if I were so motivated.

4 Results

Present the results of your experiments. Simply presenting the data is insufficient! You need to analyze your results. What did you discover? What is interesting about your results? Were the results what you expected? Use appropriate visualizations. Prefer

graphs and charts to tables as they are easier to read (though tables are often more compact, and can be a better choice if you're squeezed for space). **Always** include information that conveys the uncertainty in your measurements: mean statistics should be plotted with error bars, or reported in tables with a ± range. The 95%-confidence interval is a commonly reported statistic.

5 Conclusions

In this section, briefly summarize your paper — what problem did you start out to study, and what did you find? What is the key result / take-away message? It's also traditional to suggest one or two avenues for further work, but this is optional.

6 Acknowledgements

Thanks to Dr. Raghu Ramanujan for guidance throughout this project and Dr. Tabitha Peck for algorithmic inspiration.

References

Russell, S. J., and Norvig, P. 2003. *Artificial Intelligence: A Modern Approach*. Pearson Education.