Lecture 12: Local Image Preprocessing (Smoothing)

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Reading

SH&B, 4.3.1

12.1 Introduction

The material in Sections 4.1–4.2 should be material you've already covered in CS 450. In this lecture, we'll start covering section 4.3, which discusses both smoothing and edge detection. We'll cover smoothing only a little (since it was discussed somewhat in CS 450) and focus primarily on edge detection.

12.2 Smoothing

In CS 450, you learned that smoothing generally involves averaging. In particular, you should have learned two linear techniques:

- averaging multiple frames
- neighborhood averaging

and one non-linear technique:

- median filtering

Averaging multiple frame is an effective technique for diminishing noise, but only if you have multiple images available for the same scene.

Neighborhood averaging, though it has the advantage of working with only a single image, has the drawback that it also blurs the image. Several non-linear variations have been used that try to remove noise while still preserving sharp edges. Median filtering is one of those techniques.

Your book also describes three other non-linear techniques:

- averaging with limited data validity
- averaging according to inverse gradient
- averaging with rotating mask

In each of these three techniques, the idea is the same: examine the local neighborhood to try to determine which neighbors are part of the same region, and average only with those. This attempts to avoid averaging across object regions, thus (hopefully) avoiding blurring.[1] Notice that this introduces vision into image preprocessing: if you can accurately determine which pixels are part of the same regions, you can better smooth them to remove noise while simultaneously preserving sharpness. There are many other variations on this idea, all with the same basic motivation.

[1] If you'll pardon the analogy, a colleague of mine used to refer to this as "racist pixels": each pixel wants to be like its neighbors, but only those that are sufficiently like it already.

Vocabulary

- Non-linear smoothing
- averaging with limited data validity
- averaging according to inverse gradient
- averaging with rotating mask