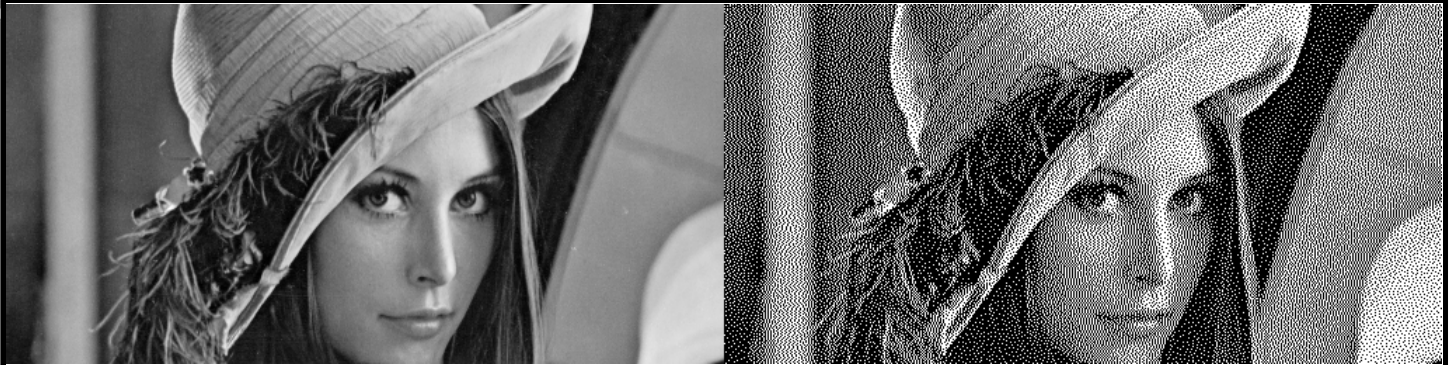# Project / Thesis
Dithering via Cut-And-Project

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Introduction

Dithering describes the technique of displaying an image with very few colors while still keeping the illusion of full color depth up. This illusion is created by mapping the original colorvalue to a pixeldesnity. Additionally, you have to place each pixel in a way, the human eye can't see any pattern, which makes it easier for humans to see the set of pixels as the original color and not as a pattern of pixels. In the titleimage you can see areas where this placement worked out very well and other areas having obvious patterns.

In this project we will focus on grayscale images and the goal is to dither them into a binary color map (i.e. black and white pixels).

Cut-and-project is a technique, projecting elements of a high dimensional space into a lower dimensional one. In this work, these elements will be points. Depending on the parameters given, the technique results in aperiodic distributions. See figure 1 for an example of a cut-and-project scheme.

Figure 1: An example of a Cut-and-Project scheme

There are different ways to dither an image. The titleimage was created using an error diffusion algorithm [1]. In this project, you will create a new way of dithering an image, based on cut-and-project schemes. The project or thesis can be split into three main parts.

1. Find cut-and-project parameters, creating aperiodic pointpatterns of as-equal-as-possible density.

2. Modify the original cut-and-project technique to allow the cutoff line to be variable, depending on the tone of the input image.

3. Merge the found parameters and the modified technique into an algorithm and implement this algorithm.

Depending on your needs, we can also split this project into two software projects as well, while one will deal with the parameters and the other one with the variable cutoff and implementation.

Assignments

The goal of this project or thesis is to create and implement an algorithm, based on cut-and-project, which will generate a dithered image from a given grayscale image.

Project Type

This project can be a master group project, a master thesis or two software projects.

Requirements

The implementation will be in C++. Thus, basic C++ knowledge is desired. Moreover, you should be familiar with linear algebra.

Work Load
- 60% Theory
- 30% Implementation
- 10% Test

Supervision
- Prof. Dr. Renato Pajarola
- Lars Zawallich (assistant)

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References

[1] Victor Ostromoukhov. A simple and efficient error-diffusion algorithm. In *Proceedings of the 28th Annual Conference on Computer Graphics and Interactive Techniques*, SIGGRAPH '01, pages 567–572, New York, NY, USA, 2001. ACM.

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