

Research Project

Texture Analysis with Information Theory

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1 Introduction

We intend to apply the ideas presented by ? to the analysis of SAR textures. Before this application, we will make an empirical study of the behavior of Information Theory descriptors when applied to the Brodatz textures. These 112 textures (?, available at <http://sipi.usc.edu/database/database.php?volume=textures>) have been used as a benchmark for image analysis (?). Figure 1 shows thirteen of these textures.

2 Methodology

We describe here the steps we followed in this research project.

2.1 Descriptive analysis

The first step of the study consists in applying the mapping described by ? to see where the textures are represented in the $\mathcal{H} \times C$ plane.

2.2 Does contrast impact?

The second step consists in verifying if contrast impacts on the mapping. Figure 2 shows two of these textures with different contrast. It is expected that changes in contrast have no effect on the mapping, since the Bandt-Pompe transformation is immune to scalings.

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2.3 Clustering

The third step consists in verifying if the points in the $\mathcal{H} \times C$ plane form clusters which are *natural* to the eye.

2.4 Impact of parameters

The fourth step consists in analyzing the impact that window size and delay have on the mapping of each texture.

3 First Results

3.1 Descriptive analysis

The first result of study consisted in mapping an set of 45 textures and analysis your behavior, as we can see in Figure 3.

3.2 Does contrast impact?

For analyze the impact of the contrast in the mapping in the $\mathcal{H} \times C$ plane, we separate two sets of textures, one with contrast apply and another not. The result we can see in Figure 4, where the colors represent the different textures and the shape inform the apply or not of contrast (triangles represents textures without contrast).

3.3 Clustering and Impact of parameters

We can observe that the settings of the Plane ($D = 5, \tau = 1$), ($D = 5, \tau = 2$), ($D = 5, \tau = 4$) can divide the set of textures into three subgroups, as shown in Figure 5. However, the impact of the contrast makes no difference in the plane view, although the characterization of the textures in Figure 4 was perfectly done in the plane by applying the settings ($D = 3, \tau = 5$).

References

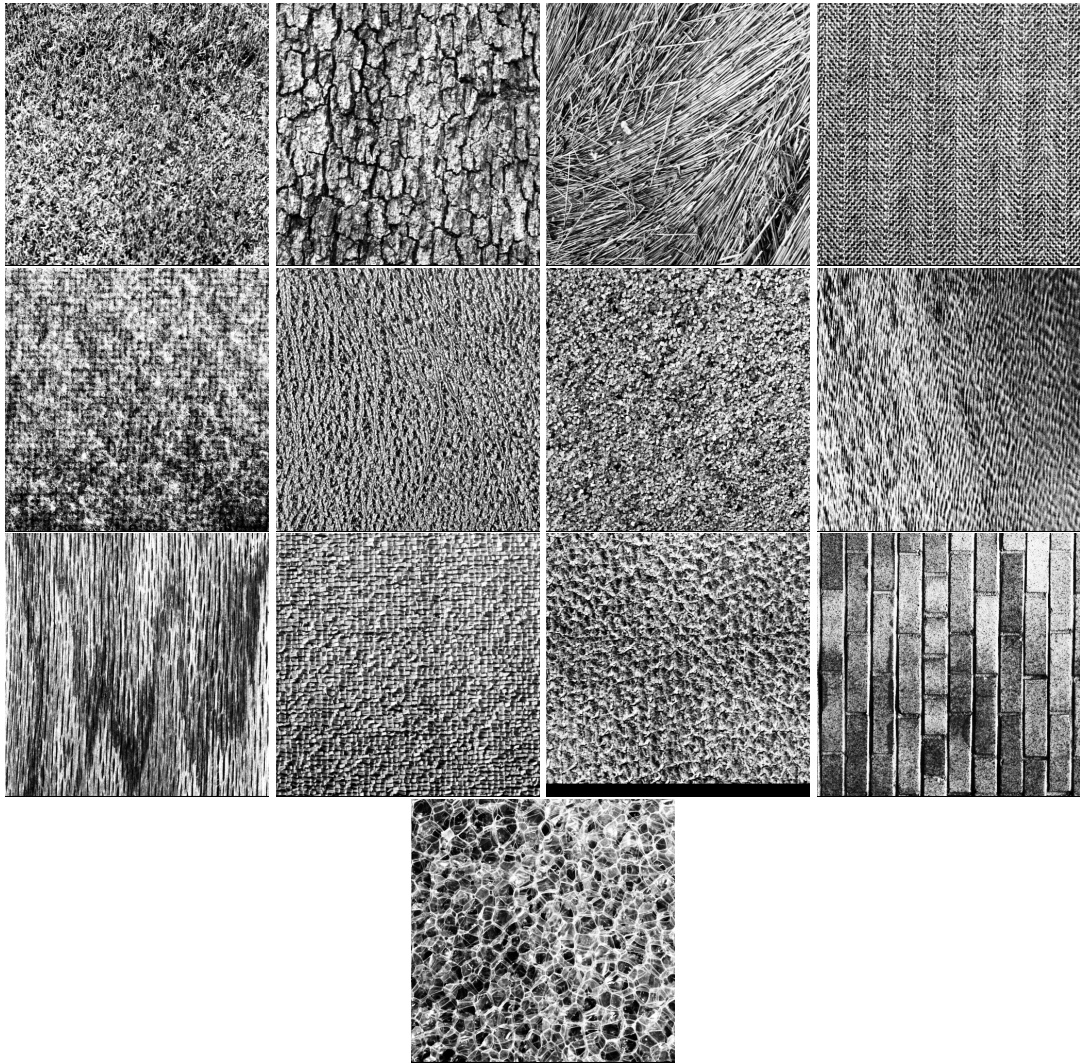


Figure 1: Brodatz textures

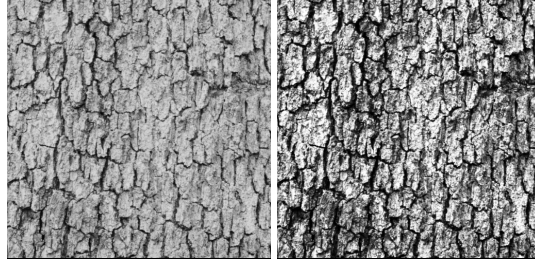


Figure 2: The same texture with different contrast

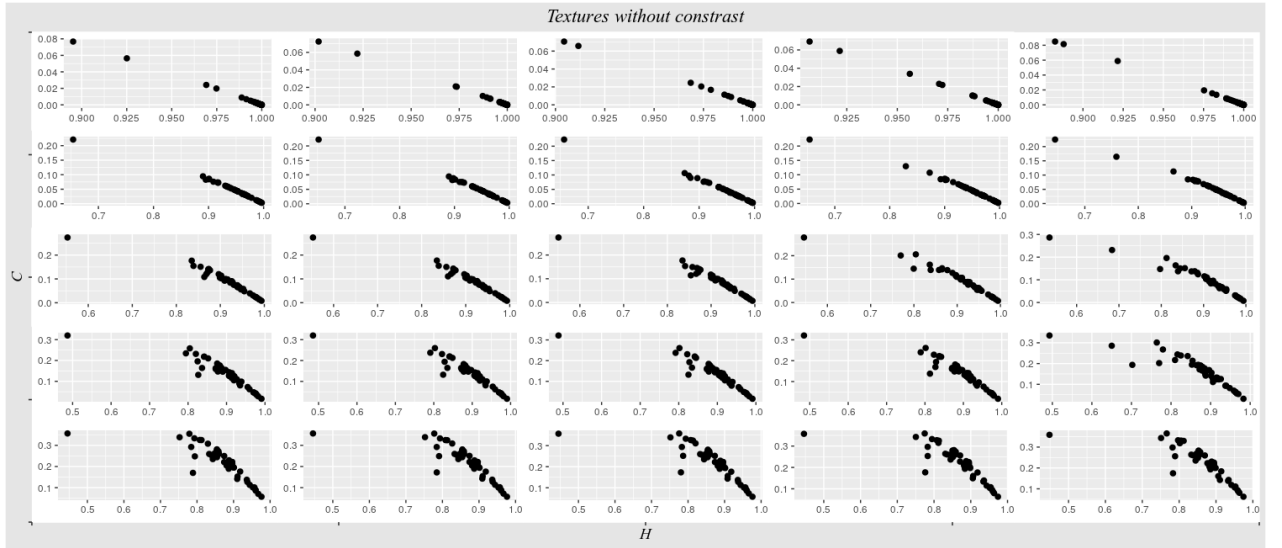


Figure 3: Set of Brodatz textures mapping in $\mathcal{H} \times \mathcal{C}$ plane

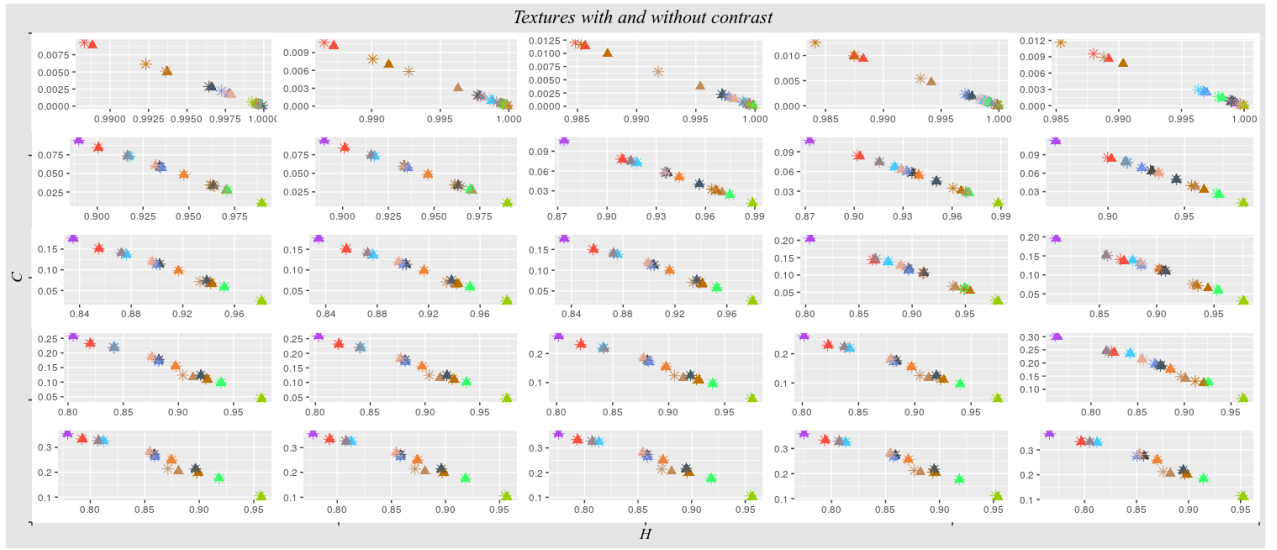


Figure 4: Set of Brodatz textures with and without contrast mapping in $\mathcal{H} \times \mathcal{C}$ plane

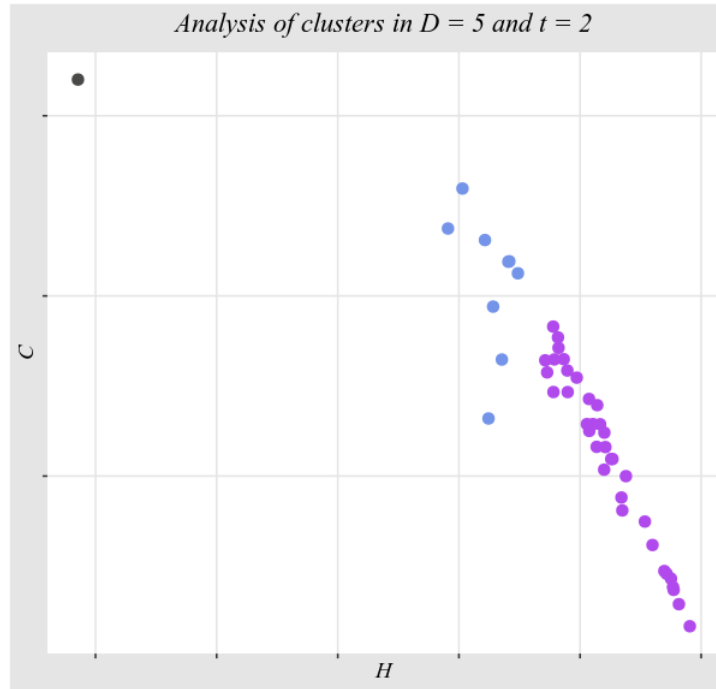


Figure 5: Clusters formed after the mapping in the $\mathcal{H} \times \mathcal{C}$ plane