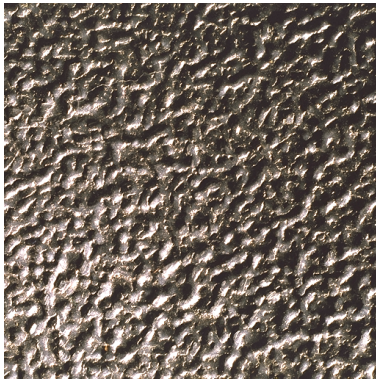


# Tutorial: Local Binary Patterns

## Note

This tutorial aims to study a texture descriptor named 'Local Binary Patterns'. The first objective is to implement this descriptor. Thereafter, digital images of textures will be classified using this descriptor and the k-means algorithm.

The different processes will be applied on this kind of texture images:



(a) metal image



(b) sand image



(c) ground image

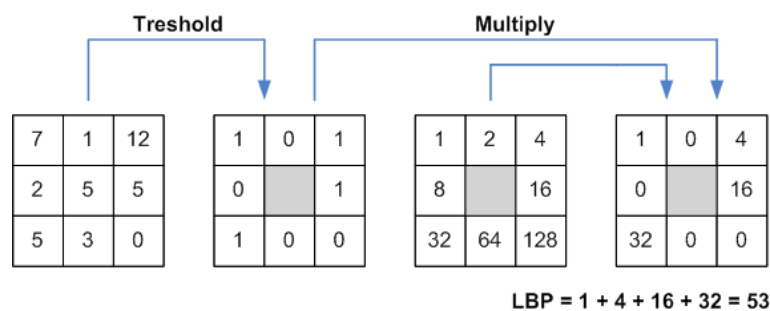
## 1 Local Binary Patterns

The Local Binary Patterns (LBP) descriptor is a simple yet very efficient texture operator which labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as a binary number. Due to its discriminative power and computational simplicity, LBP texture operator has become a popular approach in various applications. It can be seen as a unifying approach to the traditionally divergent statistical and structural models of texture analysis. Perhaps the most important property of the LBP operator in real-world applications is its robustness to monotonic gray-scale changes caused, for example, by illumination variations. Another important property is its computational simplicity, which makes it possible to analyze images in challenging real-time settings.

The LBP feature vector, in its simplest form, is created in the following manner:

- For each pixel, compare the pixel to each of its 8 neighbors (on its left-top, left-middle, left-bottom, right-top, etc.). Follow the pixels along a circle, i.e. clockwise or counter-clockwise.

- Where the center pixel's value is greater than the neighbor's value, write "1". Otherwise, write "0". This gives an 8-digit binary number (which is usually converted to decimal for convenience).
- Compute the histogram of the frequency of each "number" occurring (i.e., each combination of which pixels are smaller and which are greater than the center).
- Normalize the histogram.



- Code a function for computing the Local Binary Patterns.
- Test this operator on a texture image from the given database.



### Informations

Consider the function `hiscounts` for histogram computation.

## 2 Classification of texture images

The objective is to classify the texture images from the given database by using the LBP descriptor.



1. Calculate the LBP descriptor for each image of the database.
2. Compare the descriptors for each class of images.
3. Compute the distance between each pair of images in order to get a dissimilarity matrix. Comment the result.
4. Use the k-means algorithm to classify the images of the database into three classes ( $k = 3$ ). You can use the Matlab function `kmeans`.