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Image Quantization

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# Image Quantization

The idea of color quantization is to reduce the number of colors in a full resolution digital color  
image (24 bits per pixel) to a smaller set of representative colors called color palette. Reduction  
should be performed so that the quantized image differs as little as possible from the original  
image.

# Graph

## Why graph?

The graph is an essential input for constructing the MST. Constructing a graph will be in two steps first one is to get the unique pixel from the image in "Graph" class. Second step is to calculate the weight (distance) between each unique pixel. This step is exhaustive process as it will take much time and storage also it will take time to index it in the process of MST, so we decide to not store it and only calculate the weight (distance) that we need in MST.

## Graph construction

Graph will be constructed in "Graph" class. It consists of

* public int distinctColors
* public RGBPixel [,] ImageMatrix
* public RGBPixel [] UniqueColors
* public Graph (RGBPixel [,] ImageMatrix)
* private void GetUniqueColors ()

### Public int distinctColors

An integer variable which is initialized with zero. It refers to the number of different colors in the image.

### public RGBPixel [,] ImageMatrix

Array 2D that stores the image pixels as RGBPixel type.

### public RGBPixel [] UniqueColors

Array 2D that will be used to store only the unique pixels from ImageMatrix array.

### public Graph (RGBPixel [,] ImageMatrix)

A constructor that is used to initialize the ImageMatrix with the one in the parameter list of the constructor.

Calling "GetUniqueColors ()" function is the second usage for the constructor which get fill UniqueColors matrix once the user instantiate an object from the class to avoid using empty matrix.

### Private void GetUniqueColors ()

The function aims to find the unique pixel from the image by initializing an 3D Boolean array which is initially false and loop on the image pixels and mark the pixel which is not visited with true.

## Graph complexity

# Minimum spanning tree

## Why MST?

Minimum spanning tree is the way that connects all the vertices together, without any cycles and with the minimum possible total edge weight. Achieving this by using Prim algorithm.

## Prim construction

Prim algorithm is used to find the MST and it produce parent array, value array and minimumSpanningTreeCost

MST construction will be in "Prim" class, and it consists of

* private readonly Graph
* public int [] parent
* public double [] values
* public Prim (Graph graph)
* private int selectMinimumVertex (double [] values, bool [] setMST, int numberOfVertex)
* public double MST ()