ASSIGNMENT3

DIGITAL IMAGE PROCESSING (DIP) - CSE 478

DEADLINE: 24TH SEPTEMBER (THURSDAY)

(1) In the given "Octane" image, it is required to extract all the yellow stars. Devise a frequency domain filtering solution for the same.

(2) Develop an algorithm to perform following tasks on the "circles" image:
a) Determine number of circle categories based on size
b) Determine number of members in each category
c) Generate a binary image for each category in which category gets intensity value 255 and rest 0.
Allowed operations: Top hat filtering, global/adaptive histogram, connected components analysis, point operation, neighbourhood operation.

(3) Take a photo of yourself in front of a flat background (either bright green or any distinct color). Segment out your photo and place it front of any famous monument. [Note: do something similar to chroma keying].

(4) The basic problem with designing the map is that there is no faithful way to render the surface of a sphere on a flat surface. There is no one single kind of map that works for all purposes, and various kinds must be designed to conform to various criteria. Coordinates on the sphere are East longitude x and latitude y. Assuming the Earths surface to be a sphere of radius R, the coordinate map takes: $(x, y) \to (R \cos x \cos y, R \sin x \cos y, R \sin y)$

The simplest map just transforms longitude and latitude into x and y. It preserves distance measured along meridians, but distorts wildly distances along parallels. Image of such a map is attached herewith.

The next simplest map is called the "cylindrical projection", because it projects a point on the Earths surface straight out to a vertical cylinder wrapped around the Earth, touching at the Equator. Explicitly, $(x, y) \to (x, \sin y)$
It was proven by Archimedes in his classic On sphere and cylinder that this map preserves areas, although it certainly distorts distances near the poles.

A more interesting one is the Mercator projection :
$(x, y) \to (x, ln \tan(\pi/4 + y/2))$
Here, distances and areas near the poles are grossly exaggerated, but angles are conserved, so that plotting a route by compass is relatively simple. Indeed this is exactly the purpose for which this projection was designed. The first map of this sort was constructed by the 16th century geographer Gerardus Mercator himself, but it was likely the Englishman Thomas Harriot who understood its mathematical basis thoroughly well, as thoroughly as could be done without calculus.
Your task is to transform the given map into its:
a) Cylindrical projection
b) Mercartor projection

[Reference: `http://www.math.ubc.ca/~cass/graphics/manual/pdf/ch8.pdf`]