Practical Report: Photometric Stereo and shape from shading

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Step1:

collect image information by in importing the pictures, gaining intensity vector i(x,y)

Step2:

solve linear system V(x,y)g(x,y) = i(x,y) using linsolve function, for every pixel in image. For solving the linear system, at least 3 images needed.

Step3:

solve the parameters: ρ(x,y) = norm(g(x,y)) , normal vecter N(x,y) = g(x,y) / ρ(x,y), p = N1/N3, q = N2/N3.

Step4:

simple integration, use 2-D scan method to reconstruct the object's shape:

For first column, z(x,y) = z(x-1,y) + q(x,y)

For every row, z(x,y) = z(x,y - 1) + p(x,y)

Vector map, albedo map and height map had been output for every image set, both in this document and zip file.

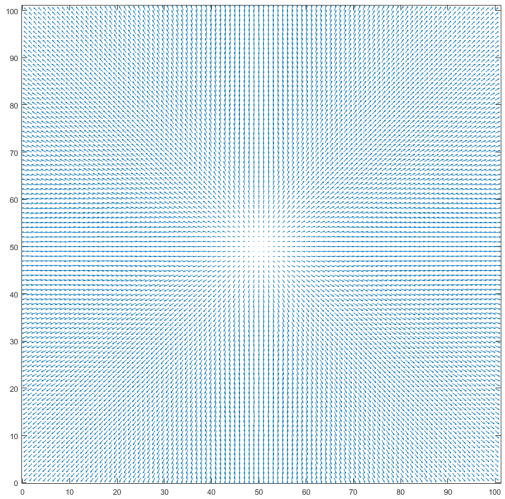
Conclusion:

1. The algorithm provided in the text book did a good job on reconstruction with a synthetic image set, it got a nearly perfect surface.

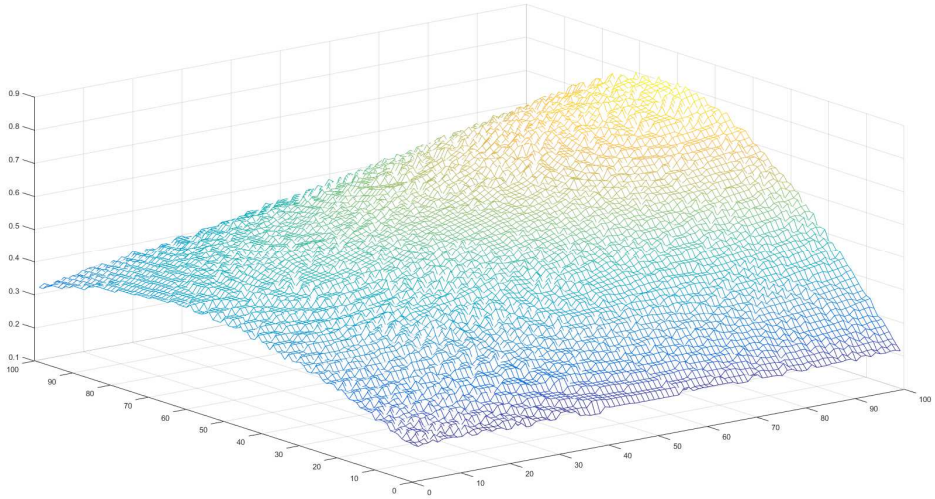
2. For a real image, when dealing with objects with a regular shape, for instance a sphere. The surface of these objects is relatively smooth, which gives a quite satisfied result in vector map and reconstruction.

3. For some objects with an irregular shape, like a bandaged toy dog, the 2-D scan method didn't work well anymore. I noticed that the vector map and albedo map are relatively acceptable, if compared with the height map. That mean the algorithm of reconstruction need be improved when dealing with objects with an irregular shape.

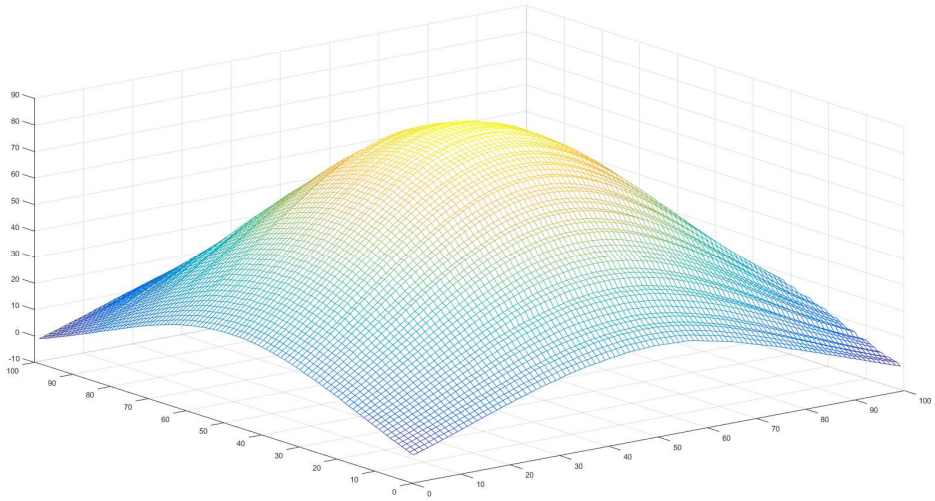
2.1 Synthetic Images:



Vector map



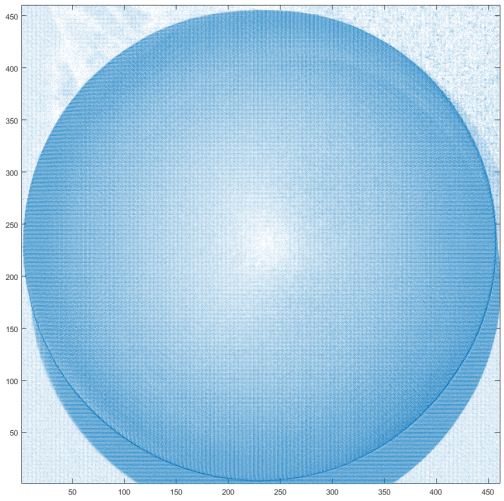
Albedo map

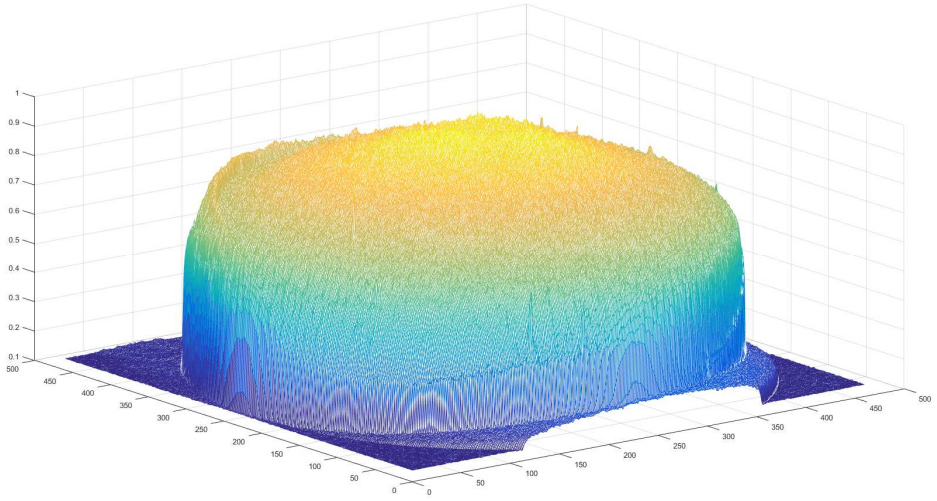


Height surface

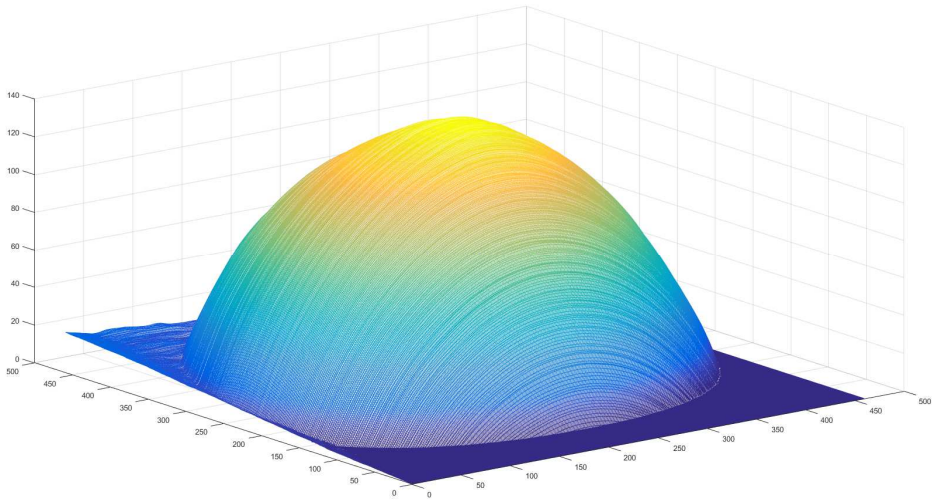
2.2 Sphere Images

Vector map



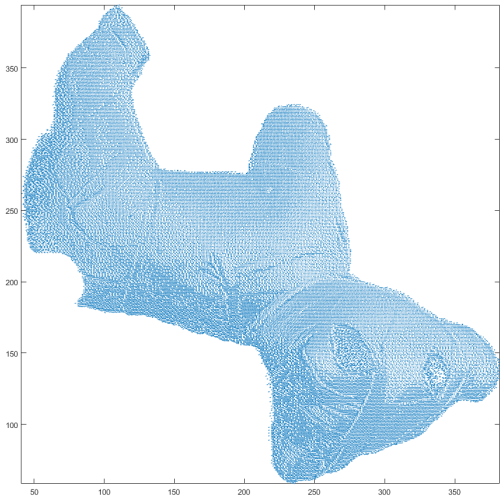


Albedo map

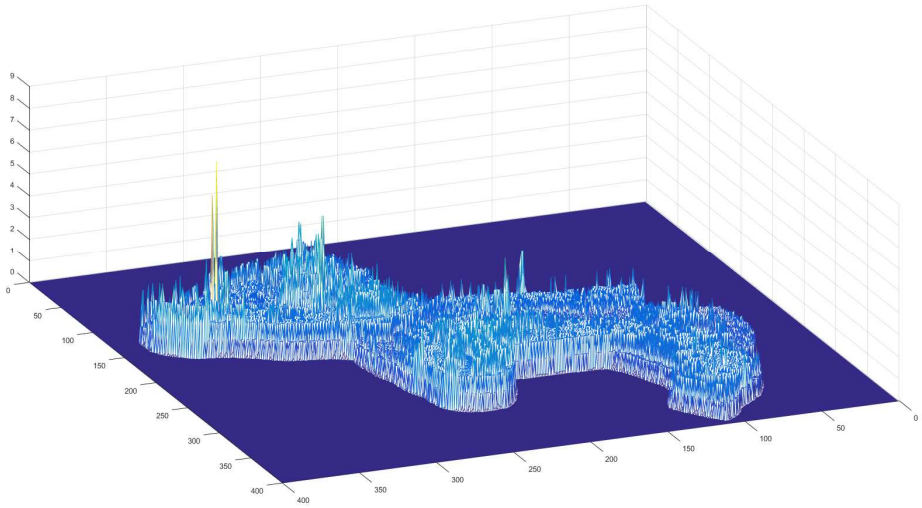


Height surface

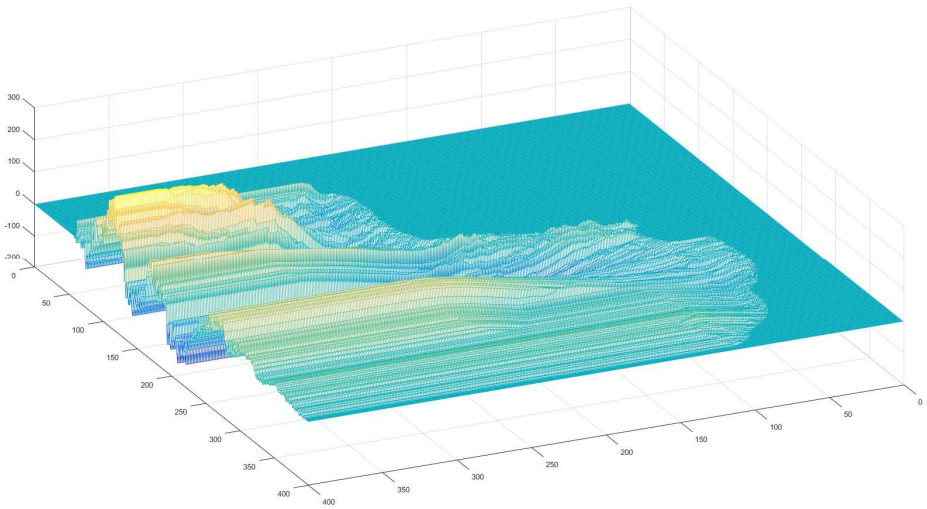
2.2 dog images



Vector map



Albedo map



Height surface