Exercise Sheet SoSe 2015
Wirtschaftsinformatik und Maschinelles Lernen (ISMLL)
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Exercise Sheet Computer Vision 5

Submission: 10.6   (3 Points)

Exercise 1   DLT   (20 Points)

a) Given following points, extracted from two images with SURF feature
   detector and extractor, use the classic DLT algorithm to compute the
   homography transformation matrix H. Show all your steps dumping the
   matrices to video after each iteration.

x (x,y,1)	x' (x',y',1)
(974.64,84.79)	(1010.37,81.95)
(1002.11,81.85)	(1151.48,75.10)
(938.91,60.76)	(973.68,58.05)
(940.81,55.39)	(975.28,52.61)
(982.48,48.33)	(1018.36,53.09)

Table 1: points

Useful methods in OpenCV:

- Objects of type Mat should be declared of type attribute $CvType.CV\_64F$

- To multiply 2 matrices: Core.gemm(...);

- To plot a Matrix: Matname.dump();

- To transpose a matrix: Matname.t();

- To compute the SVD: Core.SVDecomp(src, w, u, vt): src decom-
  posed matrix, w calculated singular values, u calculated left singular
  vectors, vt transposed matrix of right singular values;

Hint: Pay attention to matrix dimensionalities.   (10 Points)

b) How should the code be modified to use the normalized DLT algorithm?
   Explain how the normalization matrices are computed and how and when
   this normalizations is applied to the data. Why is the normalization im-
   portant?
   (5 Points)

c) Apply gradient descent on the function $f(x) = \frac{1}{4}x^4 + \frac{1}{3}x^3 - \frac{1}{2}x^2$ with
   following configurations:

   - Use step length a = 0.3 and starting point x0 = -1 and show the first
     four iterations. What is your minimum?

- Use step length a = 2 and starting point x0 = -1 and show the first four iterations. What has happened and why?

- Use step length a = 0.3 and starting point x0 = 0 and show the first two iterations. What has happened and why? Do the same again with a = 0.8 and starting point x0 = 0.5 and show the first four iterations. Where is your minimum now?

(5 Points)