Multiple View Geometry: Exercise Sheet 5

Prof. Dr. Daniel Cremers, Julia Diebold, Jakob Engel, TU Munich
`http://vision.in.tum.de/teaching/ss2014/mvg2014`

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Part II: Practical Exercises

This exercise is to be solved **during the tutorial**.

Harris Corner Detector

In this exercise you will implement the Harris corner detector. *Hint: Again, it is possible to implement this exercise without loops. However, we recommend to start with a loop-based version, and only afterwards replace the loops by single function calls. For quick testing, we provide a small image `small.png`*

1. Download `ex5.zip` from the website.
2. Compute the structure tensor as introduced in the lecture for every pixel of `img1`. As weighting function use a Gaussian Kernel with a standard deviation of $\sigma_w = 3$ pixel, and an integration window size of $2\sigma_w + 1$ pixel. *Hint: use `normpdf` and `conv2`.*
3. Compute the scoring function $C(x) := \det(M) + \kappa \, \text{trace}^2(M)$, where M is the structure tensor for pixel x, using $\kappa = 0.05$. Visualize the scoring function using `imagesc`. *Hint: if you cannot see much, try to display a non-linearly transformed scoring function, e.g. sign(C)* $\cdot |C|^{\frac{1}{4}}$.
4. Find all pixels x for which $C(x) > \theta$, and which are a local maximum of the scoring function, i.e., all four adjacent pixel have a lower score (non-maximum suppression). Use $\theta = 10^{-7}$. Display the found Harris Corners using the provided function `drawPts`.
5. Try different values for σ_w - what do you observe?

Patch Tracking

1. Compute the local velocity of each pixel from `img` to `img2`, using the formula from the slides. You can re-use the computed structure tensor from the first exercise. Visualize your result using `imagesc` *Hint: Implementing this exercise without loop is somewhat tricky.*
2. *Optional: Implement Lucas-Kanade Patch-Tracking, by iteratively re-computing the estimated velocity at the new position. Use it to track the Harris Corners found in exercise 1.*