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DMIP, WS 2015/2016

Examiner: Andreas Maier

Examination protocol

1. What topics did we deal with? → Cloud started to paint
2. He interrupts me right at the beginning, at Image Undistortion. How does it work? What does such a polynomial look like?
3. What does the matrix look like then? → I got a little confused with the notation, he wanted to know exactly.
4. How do you do Defect Pixel Interpolation? → Spatial interpolation, Fourier band limitation.
5. How does Defect Pixel Interpolation work with Symmetry Properties, with formulas? → Multiplicative model, symmetry property explained. 6. He wanted to know the exact derivation. So $g = f * w$ → $G = F$ [convolution] W. Then write down the convolution as the sum, what is left if you only consider two line pairs? He wanted to get down to the formula, I'm just not sure whether it is correct: $G (Xi) = F (Xi) * W (0) + F (Xi-N) * W (2 * Xi + N)$. Then use Symmetry Property $F (Xi-N) = F\_conjugated (Xi)$ and $W (2 * Xi + N) = W (2 * Xi)$ because of the property of the Fourier transform. → Then do iteratively
7. When do you stop iterating? → If the error is small, i.e. $f\_estimated * w = g$
8. Reconstruction. → Is there an analytical FBP Fourier slice or iterative
9. Explain Fourier Slice Theorem. → picture painted
10. How does filtered back projection work now? → Filter the projection with an inverse Fourier transformed ramp filter, then back projection.
11. Where does the $| w |$ come from filter? → First of all, explained intuitively, in the Fourier space you have to weight the mean values less.
12. And how do you come up with $| w |$? → Via the Jacobi matrix because of the coordinate transformation.
13. Ok iterative reconstruction, how does it work? → One equation per ray, system of equations is too big to solve with SVD.

14. How do you do it then? → e.g. Kaczmarz method
15. How does it work? → Painted the picture, with every equation is a straight line. The estimated values are alternately projected onto the straight lines.
16. What does the iterative formula look like then? → I didn't know directly, but with a little help I figured it out.
17. Registration, how does it work? → Point based, image based, ICP
18. How can rotations be represented? → 2D or 3D?
19th 3D. → Euler Angles, Axis Angle, Quaternions.
20. What are quaternions? → Extension of the complex numbers with 3 imaginary parts.
21. What does a rotation with quaternions look like if r is the rotation quaternion? → $q = r * p * r\_conjugated$
22. Ok but that's square, how do you get it linear? → $q * r = r * p$, one can then minimize.
23. Why is it allowed to do that? Because r is a unit quaternion.

I asked why he immediately interrupted me while painting clouds. Said that otherwise some people would just paint the whole test on the cloud.
Unfortunately, I was quite unsure about the formulas and often got confused with the notation and he had to help me in many places, but the grade was still better than expected!

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