

# Student Intern (m/f) in the fields of Image Processing and Computer Graphics

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**keywords:** computer graphics, image processing, robotics, surface inspection, master thesis, bachelor thesis, seminar, applied research project

The department **Image Processing** of Fraunhofer ITWM makes use of and expands the most recent scientific breakthroughs for two main purposes: analysis and modelling of micro- and nanostructures and development of the state-of-the art machine vision systems. Our products allow both inspection and optimization of everyday production processes in most different industries all over Europe

## RayPlan – the project you would be working on

RayPlan focuses on achieving new advances in vision based surface inspection systems by combining computer graphics, image processing and robotics. If you would want to find a defect on a surface of an object, just by looking at it, you would probably rotate the object in your hands, while checking if anything “behaves differently” from what you would expect. Now, try to reconsider some of the elementary steps you would have had to do in order to inspect the object – find the appropriate combination of rotation, light source and viewpoint angles, as well as get the knowledge of how the correct surface should look like, etc. The process sounds pretty straight forward, until you try to get the computer to do it automatically for various cases. That is where we jump in!

In this particular part of the project, we decided to take the surface as the main source of our “troubles” since its behavior varies greatly from one material to the other and, somehow, restrains it. In order to tackle the problem, we want to be able to reconstruct the micro geometry of the surface using photometric stereo methods. In addition, we want to read its light response parameters and turn them into a model. This will be further used to generate multiple instances of the same surface. The model will allow optimization of imaging conditions as well as introduce the possibility to develop novel approaches to defect detection and estimation of its behavior.

We offer you a possibility to work with us and get credit for it from your university by working on topics such as:

- Micro surface normal field reconstruction based on mobile images
- Micro surface geometry reconstruction using photometric stereo
- Photometric stereo using robotic arm carrying different light sources
- Reverse engineering of surface illumination based on photometric stereo sequence

## Responsibilities

- Design and implement image based surface normal estimation algorithms
- Make pixel wise BRDF estimation
- Combine image processing and computer graphics algorithms
- Apply normal fields onto a simple 3D model
- Write optimized, well-documented, version controlled code

## Preferred qualifications

- Background in computer sciences, math or engineering
- Advanced use of English language
- Ability to prioritize and manage workload
- High level of personal responsibility
- Experience with C++ and Python
- Experience with visualization libraries such as CGAL or VTK
- Experience with image processing library OpenCV

## What we offer

- Experience of contributing to a real research project and making an impact
- Awesome casual work atmosphere that is simultaneously motivating, friendly and productive
- Supporting environment for constant professional development
- Possibility of further collaboration
- Support and feedback from a team of mathematical experts

## Application

Send your resume and motivation letter to [petra.gospodnetic@itwm.fraunhofer.de](mailto:petra.gospodnetic@itwm.fraunhofer.de)

Application deadline: ongoing recruitment