

Thank you for dating us at the Career Speed Dating. We hope it was more than just a one time thing 😊

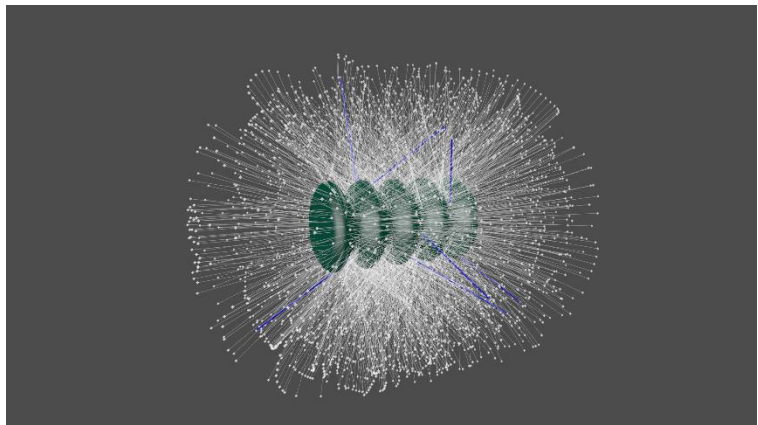
At Image Processing Department we have a lot of different and exciting positions with varying topics which are directly relevant to the industry and are always happy to discuss possibility of offering you a PhD position or potential cooperation in terms of Erasmus internship or bachelor and master thesis supervision.

You can find out more about all that we do at www.itwm.fraunhofer.de/en/departments/by.

For now, let's focus more on the Virtual Image Processing research group – the group where we bring together different fields such as computer vision, computer graphics, machine learning and robotics in order to make a completely new platform which will transform the factories worldwide. In this group we have contact with various high-profile universities worldwide as well as leading companies in aviation, automotive and metrology industries. Through this contact we identify what is needed in the market and make sure it is developed and available on time.

VIRTUAL IMAGE PROCESSING

Factories are becoming increasingly automated. Production facilities are becoming more flexible, so that no new plants have to be built when switching to new products. Visual inspection system hardware configuration – the last nail preventing the inspection systems to be truly purpose-flexible and thus ready for the implementation as a part of Industry 4.0 process chain. Production lines are more and more versatile, and products are changing rapidly, confronting inspection systems with more complex surfaces and materials. Every step of the production is controlled and digitalized to be as flexible as possible. And yet, when it comes to inspection, months of pre study are required, and no off-the shelf solution is available which can be easily adapted to different use cases and surfaces of different complexity.



Making Processes more Flexible and Efficient

However, quality control is often neglected. Inspection systems are still rigid and have to be designed for specific products. An inspection system consists of many hardware components, typically selected and parameterized by experienced engineers based on physical tests. New systems are developed iteratively. Experts design an initial system, which is then modified until it can inspect the product with sufficient accuracy. These tests of different hardware solutions cost a lot of time and effort - several hours per test run. Therefore, a configuration is often chosen that works but is not optimal. The resulting sub-optimal image quality must be algorithmically compensated later.

To make this process more flexible and efficient, we are developing an adaptive, simulation-based framework that will revolutionize the development process for inspection systems. In the future, industrial inspection systems will be completely virtual designed and tested for reliability using this framework.

Virtualization Core in Focus

The key to virtual image processing lies in the virtualization core, consisting of two interconnected components: planning and simulation. Simulating what the camera sees can be used to evaluate the design plan of an inspection system.

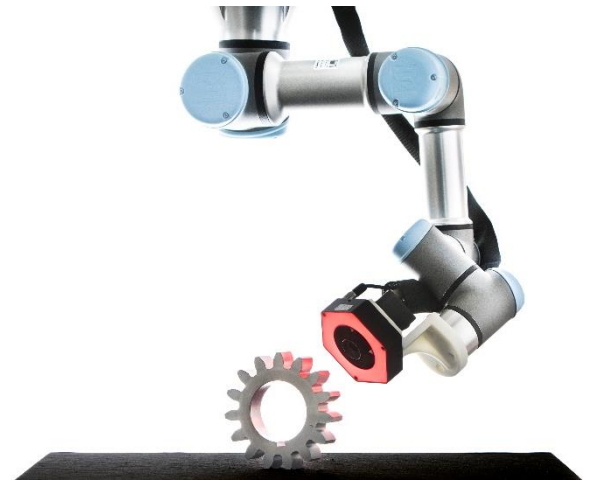
The core is fed by a CAD model – the geometry – of a product, along with different inspection parameters, for example the types of defects, product material, and inspection speed. Based on these parameters, the core will output a set of possible solutions and parameters, which an engineer can then use to adapt an inspection system, as well as the expected results, for example sensing viewpoints, light positions, and simulated inspection images.

The framework is currently being researched and developed on several fronts in parallel:

- Active model-based position planning and optimization
- Physically accurate texture synthesis
- Synthetic image dataset generation for ML training
- Industrial image synthesis
- Flexible computer vision algorithms for automated surface inspection

Research Group Diversity

The research group combines knowledge in fields of *image processing, computer graphics, machine learning* and *robotics* to make optical inspection of complex products possible. Such work is both challenging and satisfying at the same time, giving the opportunity to create a new field of research.



We are always looking for motivated students curious to tackle new challenges and push boundaries of what is considered possible. Get in touch and let's discuss what we can do together.

Make sure to check out our web pages at www.itwm.fraunhofer.de and get in contact!



A handwritten signature in black ink, reading "Petra Gospodnetic".

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