



Title:	Internship proposal.
Document Revision:	1.0
Publication date:	16/02/2022
Author:	Nathan Greffe, Nathan.Greffe@euresys.com

## 3D Alignment using Point Pair Features.

### 1 Context

Euresys is a leading and innovative high-tech company, designer and provider of image and video acquisition components, frame grabbers, FPGA IP cores and image processing software. Euresys is active in the computer vision, machine vision, factory automation, medical imaging, and video surveillance markets.

This internship will take place in the Vision software team under the supervision of an experienced software engineer. Euresys is located at Liège Science Park.

The Vision team recently developed Easy3DMatch, a product allowing an easy detection of defects on manufactured 3D objects. It consists in comparing a 3D scan of the object with a reference (cad model or golden scan). The first step of the comparison is to align the scan on the reference. A popular approach to perform 3D alignment is to use Point Pair Features (denoted as PPF in the rest of this document). This method was initially developed by [Drost et al. \[1\]](#) and many improvements and variations were published since. While Euresys already developed a solution to perform 3D alignment, we are curious to see how it compares with SOTA PPF approaches.

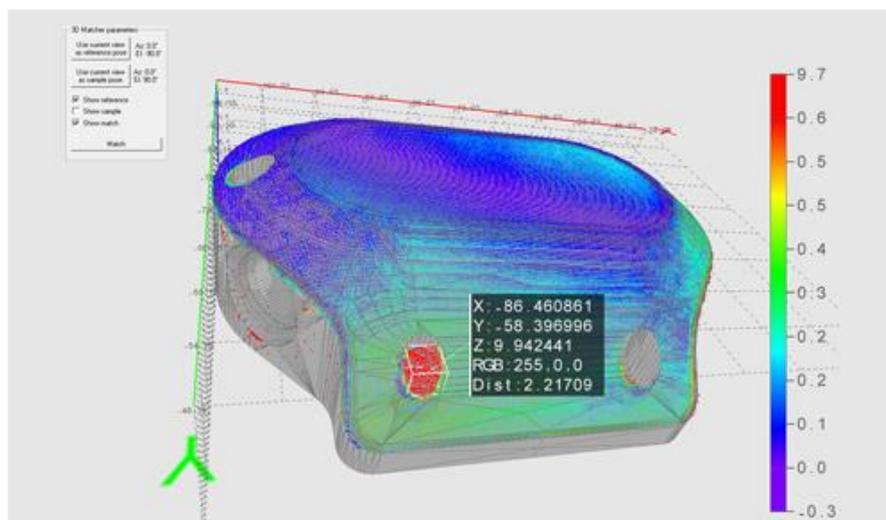


Figure 1 Typical result of a comparison using Easy3DMatch: defect is in red, reference in gray and sample in colors

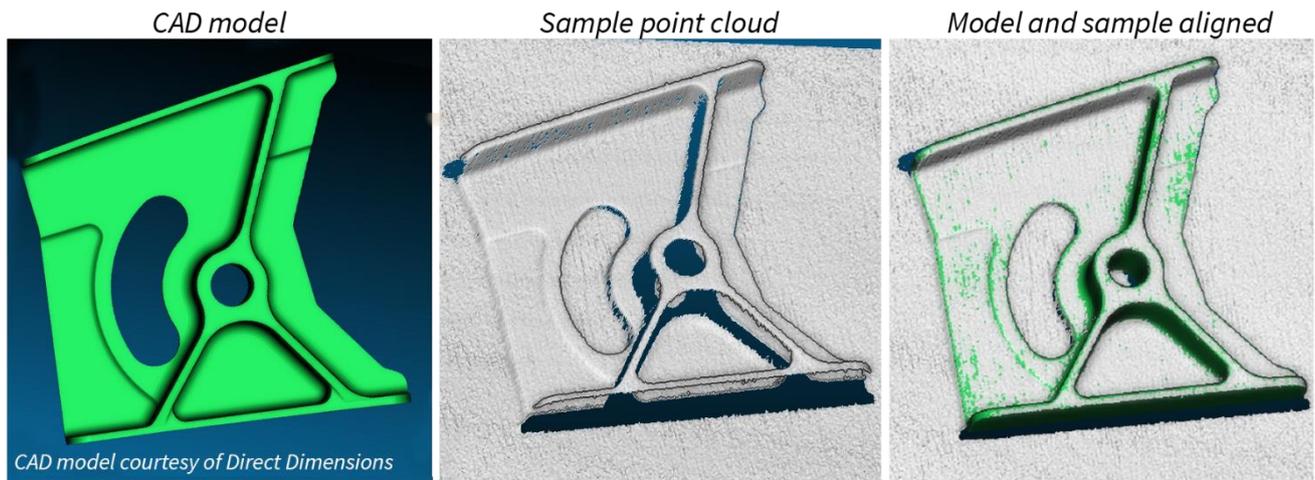


Figure 2 Illustration of the 3D alignment process

## 2 Objective

The objective of the internship is to implement and benchmark (some of) the PPF algorithms presented in the literature. It will start by an extensive literature review on the subject. Then, the student will be asked to implement one or several solutions, to benchmark them against Easy3DMatch and to iterate on these results. Euresys has an internal benchmarking dataset that would be put at the disposal of the student. Public datasets could be used as well.

While we already have a few tracks in mind, the intern is encouraged to discuss new ideas or papers he/she would discover during his/her internship.

## 3 Requirements

The intern should have knowledge of C/C++ and basic maths/optimization. Experience with 3D processing and OpenCV is a plus.

We expect this subject to be realized as a master thesis, not a 10 ECTS internship.

1. Drost, Bertram, Markus Ulrich, Nassir Navab, and Slobodan Ilic. "Model Globally, Match Locally: Efficient and Robust 3D Object Recognition." In 2010 IEEE Computer Society Conference on Computer Vision and Pattern Recognition, 998–1005. San Francisco, CA, USA: IEEE, 2010. <https://doi.org/10.1109/CVPR.2010.5540108>.