JOHAN EKEKRANTZ

PERSONAL INFORMATION

Born in Stockholm, Sweden, 11 July 1986

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WORK EXPERIENCE

June 2017 – present Computer Vision and Machine Learning Scientist, Univrses AB — Stockholm, Sweden

Univrses AB

Working on visual odometry, lidar slam and other related topics. Algorithm development and coding. Work in C++ and Python.

2012 – June 2017 PHD Student, KTH RPL - Robotics, Perception and Learning Lab (formerly CVAP) — Stockholm, Sweden

Royal Institute of Technology (KTH)

Focus on mobile robotics and computer vision for long term applications. Particularly interested in pointcloud registration, robust estimation, self-tuning estimation, 3D-slam, object modelling, bundle adjustment, unsupervised segmentation and other related topics. PHD thesis and Journal article on unsupervised object detection and segmentation currently under internal review. Most work in done in C++.

May 2016 – April 2017 IT consultant, Combitech AB — Stockholm, Sweden

Combitech AB

Part time job as IT consultant in Computer Vision, using thermal cameras in industrial setting. Work in done in C++.

Jun-Dec 2010 Software engineer, Saab Technologies — Stockholm, Sweden

Saab Technologies

Summer and part time job as a software engineer at the RnD department. Worked mostly on software controlled automated testing of hardware components. Work in done in C.

Jun-Aug 2006 Summer job, MicroSystemation AB — Stockholm, Sweden

MicroSystemation AB

Summer job, hardware production and testing.

EDUCATION

2012-present **Royal Institute of Technology, Stockholm**

PHD in Computer Science

Department: RPL - Robotics, Perception and Learning Lab (formerly CVAP)
Focus: Mobile robotics and computer vision for long term applications.
Title: *Fully autonomous lifelong unsupervised learning of 3D object models*
Interests: Pointcloud registration, robust estimation, 3D-slam, unsupervised segmentation, bundle adjustment and other related topics.
Supervisors: Prof. Patric Jensfeldt & Assoc. Prof. John Folkesson

2005-2015 **Royal Institute of Technology, Stockholm**

Masters of Science in Engineering

School: School of Computer Science and Communication
Focus: Autonomous systems, Computer science.
Thesis: *Visual Attention using 3D Context*
Description: This thesis explored the idea of using the 3D context of objects to determine the regions in an image where a certain class of objects might occur. This is achieved by using depth information from a Microsoft Kinect sensor and machine learning techniques such as support vector-machines, k-means clustering and gradient-descent based boosting.
Supervisors: Prof. Patric Jensfeldt & Dr. Alper Aydemir
Examiner: Prof. Stefan Carlsson

PUBLICATIONS

2017 **Adaptive Cost Function for Pointcloud Registration**

Arxiv, submitted to IEEE Transactions on Robotics

In this paper we introduce an adaptive cost function for pointcloud registration. The algorithm automatically estimates the sensor noise, which is important for generalization across different sensors and environments. Through experiments on real and synthetic data, we show significant improvements in accuracy and robustness over state-of-the-art solutions.
Authors: **Johan Ekekrantz**, John Folkesson, Patric Jensfelt

2016 **Towards an adaptive system for lifelong object modelling**

ICRA 2016 Workshop: AI for Long-term Autonomy

In this paper, a system for incrementally building and maintaining a database of 3D objects for robots with long run times is presented. The system is a step towards lifelong autonomous object modelling using a mobile robot. The proposed solution iteratively fuses observations as they arrive into better and better models. By greedily allowing the system to fuse data, mistakes can be made. The system continuously seek to detect and remove such errors, without the need for batch updates using all known data at once.
Authors: **Johan Ekekrantz**, Nils Bore, Rares Ambrus, John Folkesson, Patric Jensfelt

2015 **Probabilistic Primitive Refinement algorithm for colored point cloud data**

European Conference on Mobile Robots 2015

In this work we present the Probabilistic Primitive Refinement (PPR) algorithm, an iterative method for accurately determining the inliers of an estimated primitive (such as planes and spheres) parametrization in an unorganized, noisy point cloud. The measurement noise of the points belonging to the proposed primitive surface are modelled using a Gaussian distribution and the measurements of extraneous points to the proposed surface are modelled as a histogram. Given these models, the probability that a measurement originated from the proposed surface model can be computed. Our novel technique to model the noisy surface from the measurement data does not require a priori given parameters for the sensor noise model. The absence of sensitive parameters selection is a strength of our method. Using the geometric

information obtained from such an estimate the algorithm then builds a color-based model for the surface, further boosting the accuracy of the segmentation. If used iteratively the PPR algorithm can be seen as a variation of the popular mean-shift algorithm with an adaptive stochastic kernel function.
Authors: **Johan Ekekrantz**, Akshaya Thippur, John Folkesson, Patric Jensfelt

2015 Unsupervised learning of spatial-temporal models of objects in a long-term autonomy scenario

International Conference on Intelligent Robots and Systems 2015

We present a novel method for clustering segmented dynamic parts of indoor RGB-D scenes across repeated observations by performing an analysis of their spatial-temporal distributions. We segment areas of interest in the scene using scene differencing for change detection. We extend the Meta-Room method and evaluate the performance on a complex dataset acquired autonomously by a mobile robot over a period of 30 days. We use an initial clustering method to group the segmented parts based on appearance and shape, and we further combine the clusters we obtain by analyzing their spatial-temporal behaviors. We show that using the spatial-temporal information further increases the matching accuracy.
Authors: Rares Ambrus, **Johan Ekekrantz**, John Folkesson, Patric Jensfelt

2014 Long-term topological localisation for service robots in dynamic environments using spectral maps

International Conference on Intelligent Robots and Systems 2014

This paper presents a new approach for topological localisation of service robots in dynamic indoor environments. In contrast to typical localisation approaches that rely mainly on static parts of the environment, our approach makes explicit use of information about changes by learning and modelling the spatio-temporal dynamics of the environment where the robot is acting. The proposed spatio-temporal world model is able to predict environmental changes in time, allowing the robot to improve its localisation capabilities during long-term operations in populated environments. To investigate the proposed approach, we have enabled a mobile robot to autonomously patrol a populated environment over a period of one week while building the proposed model representation. We demonstrate that the experience learned during one week is applicable for topological localization even after a hiatus of three months by showing that the localization error rate is significantly lower compared to static environment representations.
Authors: Tomas Krajnik, Jaime P. Fentanes, Oscar M. Mozos, Tom Duckett, **Johan Ekekrantz**, Marc Hanheide

2013 Enabling Efficient Registration using Adaptive Iterative Closest Keypoint

IROS 2013 Workshop on Planning, Perception and Navigation for Intelligent Vehicles

Registering frames of 3D sensor data is a key functionality in many robot applications, from multi-view 3D object recognition to SLAM. With the advent of cheap and widely available, so called, RGB-D sensors acquiring such data has become possible also from small robots or other mobile devices. Such robots and devices typically have limited resources and being able to perform registration in a computationally efficient manner is therefore very important. In our recent work, we proposed a fast and simple method for registering RGB-D data, building on the principle of the Iterative Closest Point (ICP) algorithm. This paper outlines this new method and shows how it can facilitate a significant reduction in computational cost while maintaining or even improving performance in terms of accuracy and convergence properties. As a contribution we present a method to efficiently measure the quality of a found registration.
Authors: **Johan Ekekrantz**, Andrzej Pronobis, John Folkesson, Patric Jensfelt

2013 Adaptive iterative closest keypoint

European Conference on Mobile Robots 2013

Finding accurate correspondences between overlapping 3D views is crucial for many robotic applications, from multi-view 3D object recognition to SLAM. This step, often referred to as view registration, plays a key role in determining the overall system performance. In this paper, we propose a fast and simple

method for registering RGB-D data, building on the principle of the Iterative Closest Point (ICP) algorithm. In contrast to ICP, our method exploits both point position and visual appearance and is able to smoothly transition the weighting between them with an adaptive metric. This results in robust initial registration based on appearance and accurate final registration using 3D points. Using keypoint clustering we are able to utilize a non exhaustive search strategy, reducing runtime of the algorithm significantly. We show through an evaluation on an established benchmark that the method significantly outperforms current methods in both robustness and precision.
Authors: **Johan Ekekrantz**, Andrzej Pronobis, John Folkesson, Patric Jensfelt

OTHER INFORMATION

Awards

2012 · Nominated for the *SAIS Best AI Master's Thesis Award*

2005 · *Science student of the year* – Bromma Gymnasium

Parental leave

2012-2013 · Part time

2015-2016 · Part time

Supervisory roles

2015 · co-supervised Dario Facchini master thesis *The challenges of immersive stereo augmented reality with video head mounted displays*

2015 · co-supervised Jacob Greenberg master thesis *Visual Odometry for Autonomous MAV with On-Board Processing*

Languages

Swedish · Mothertongue

English · Good

Interests

Mixed Martial Arts · Carpentry · Boardgames · Cooking

9 oktober 2017