

# Master Thesis: Deep learning applied to Real World Robotic System

Availability: February 2019, Singapore

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## Introduction

TUMCREATE is a leading Research Institute set up by the Technical University of Munich, Germany in collaboration with the Singapore Government. TUMCREATE has received funding and support for the SPEED-CARGO project from the Civil Aviation Authority of Singapore (CAAS) & the national Research Foundation (NRF) to develop automation solutions that will transform the Air Freight Logistics sector. The SPEEDCARGO solution will be the world's first AI-powered robotic solution for automatic build-up and break down of aviation cargo pallets and will help Singapore lead the transformation of the Logistics industry globally. The project is seeking technical experts with a passion for creating world class products, and a willingness to work in a fast paced, quality obsessed, multi-cultural global environment. On successful completion, the project will be spun off as a start-up with members of the project team having the option to join the start-up with benefits that include attractive ESOPs. Apply now if you are interested in working on cutting edge technologies, changing the world with your work and joining a dynamic start-up team.

More details on the project:

<https://www.speedcargo.sg/>

## Background

The design of real-world robotic systems is a multi-disciplinary effort. It involves the development of advanced perception systems, artificial intelligence-based decision making, mechanical elements like sensors and actuators, electronic components for connecting and controlling the mechanical elements and software for higher-level planning and process control.

### ABOUT TUM CREATE

TUM CREATE innovates. We are developing cutting-edge electric vehicle technologies and pioneering the *Ultimate Public Transport System* concepts for the growing transport and sustainability challenges in fast-growing tropical megacities. Germany's *Technical University of Munich (TUM)* and Singapore's *Nanyang Technological University (NTU)* — two world-leading engineering universities — have come together to collaborate on this ambitious joint research programme. It is funded by Singapore's National Research Foundation.

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This thesis will focus on development of specific computer vision modules for the perception system within SPEEDCARGO. It will involve the following specific task which the successful candidate will have to execute towards a real-world working application.

1. Photo realistic texture generation and mapping for synthesizing geometry and appearance of airfreight shipments. This data will be used for training a deep neural network
2. Implementing a C++ pipeline for a deep edge neural network trained on the data set specific in point 1
3. Integrating, testing a deploying the module within CargoEye
4. Algorithm for generating synthetic data of closely packed boxes on an airfreight ULD pallet adhering to airline regulations. Using this dataset to do deep edge learning using the framework specified in point 2
5. Design, modelling and implementation of a 3D calibration framework for 3D camera sets using a non-planer and precision engineered cubic pattern

## Objective & tasks

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Successful candidate will be working in a team to primarily integrate software components of a large robotic system that includes an industrial robot, actuating end effectors, vision sensors, high level robot control and intelligent systems. There will be potential to do development in a wide range of these areas. The primary responsibility of the candidate will be development, testing and deployment of tasks specified above.

## Mandatory Requirements

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1. Since the project will focus on real world deployment of industrial robotics system, we require the candidate to have hands on experience working on computer vision for real world systems (preferable in Industry).
2. Master/Bachelor Degree from a reputed university
3. Strong fundamentals in computer science and mathematics related to Computer Vision.
4. Past internships/working experience in reputed universities and robotics research labs is essential

## What we expect from you

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- Relevant experience in deep learning frameworks (tensor flow and caffe) and applied to practical and real world system
- Statistical analysis, State Estimation (Kalman Filters, Particle Filters) and Machine Learning (SVM, Decision Trees, Neural Networks).
- Experience with parallel computing like CUDA etc.
- Experience working in a software development team with best practice methods implemented
- Familiarity with ROS, C/C++, Java, Python, Linux, git, OpenCV, PCL, OpenGL, MATLAB
- GUI and Mobile App Development
- Ability to work independently

## What we offer you

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- An international and multidisciplinary working environment
- Opportunity to work on deep-tech robotic system
- Challenging tasks with real-life relevance

**PLEASE NOTE THAT ONLY SHORTLISTED CANDIDATES WILL BE CONTACTED**

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