# Deep learning for Device Identification

Internship Master Student

Topic

Crownstone is a startup that develops tech in power outlets. The Crownstone chip can be put on top or behind a power outlet and obtain information about current and voltage patterns from devices that are plugged into it. Moreover, it is able to react to the presence of people. It can turn off a fan when no one is around.

There are many devices in a common household: fridges, televisions, adapters, microwaves, lamps, blenders, drills. Preliminary studies into device identification show ([Crownstone blog](#)) that it is possible to identify the different household devices using usage patterns over the day. Fine grained information using current and voltage information can however be used to be beyond this and give real-time feedback to the user. This makes it possible to directly recognize a dangerous device such as a drill or blender without a long training period.
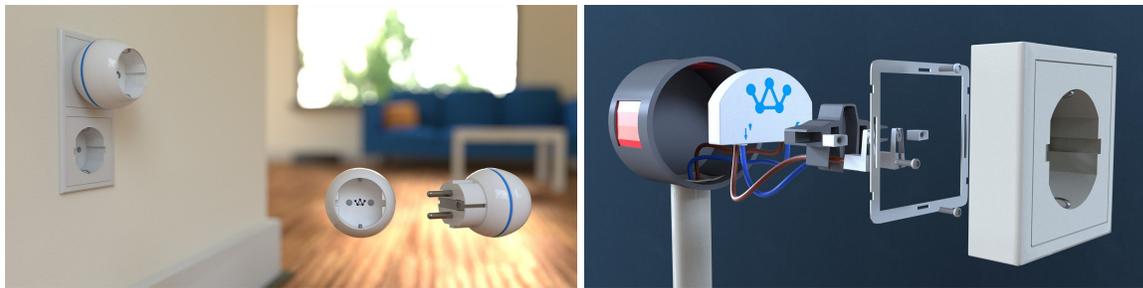
Function description

It is your task to work on the machine learning part of this problem. Your responsibility is to collect fine-granular data of multiple devices using the Crownstones, find out how to classify these devices using state-of-the-art machine learning, speed up the classification process so it operates in real-time, and implement it on smartphone devices.

The internship normally starts with an academic problem description together formulated with your supervisor, continues with a thorough literature study, defines the problem in a mathematical way and solve it using the programming language you master or will master. Almost all of our code is open source (github). Many other interns are working at Crownstone and we have a lot of experience with guiding you through the process. You won't be just getting the coffee at our place! We have high expectations w.r.t. your work! And... foosball skills are appreciated. :-)

The preferred technology to be used in this internship is deep learning. TensorFlow is an open-source library that is mature enough to run also on Android. It has been used for image

classification and natural language tasks. To use TensorFlow for device identification will be a first. Hence, not only is this very constructive for your curriculum vitae, it is also of considerable academic interest.

Background

This internship is an initiative of Crownstone.

Crownstone (2016) is a startup in Rotterdam that brings technology to detect people and devices into every building. The Crownstones estimate a person's position through the smartphone. The Crownstones measure current and voltage to detect devices and examine their usage (http://crownstone.rocks).

Function requirements

A student in the master Mathematics, Artificial Intelligence, Computer Science, Knowledge Engineering, Machine Learning, or related disciplines. For us, personal motivation is just as important as experience. Fluent English is essential. It is *not* required to speak Dutch, but appreciated of course.

Knowledge about the following topics is desired:
- General machine learning methods (supervised, unsupervised, reinforcement learning);
- Deep learning (perceptrons, autoencoders, backprop, convolutions);
- Programming skills (TensorFlow uses Python & C++).

For further information, see https://crownstone.rocks. Many master students have graduated at the Almende Group (of which Crownstone is a spin-off), see our hall of fame at https://crownstone.rocks-hall-of-fame. Your task is to find your own academic supervisor. We have worked with among others prof. Robert Babuska, prof. Pim Haselager, assist. prof. Rico Mockel, assist. prof. Kurt Driessen, assist. prof. Y (Wolf) Song, assist. prof. Dap Hartmann, assist. prof. Gerard Vreeswijk, prof. Bart de Schutter, assist. prof. Dimitri Jeltsema, prof. Nikolaus Correll, assist. prof. Marco Wiering, and are looking forward to collaboration with you and your supervisor!

Crownstone	University
Anne van Rossum anne@crownstone.rocks	Your academic supervisor(s)