School of Photovoltaic and Renewable Energy Engineering
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PhD at the University of New South Wales, Sydney, Australia

Machine learning application for luminescence imaging

The **School of Photovoltaic and Renewable Energy Engineering** (SPREE) is one of the eight schools within the Faculty of Engineering at the **University of New South Wales** (**UNSW), Sydney, Australia**.

The school is widely considered as the **best in the world**. Building on its world-leading research, the **school attracts leading international researchers in the area of photovoltaic.** Our academic staff has been consistently ranked **amongst the leaders worldwide in the photovoltaic field** through international peer review. Our team has held the world record for silicon solar cell efficiencies for over twenty years and has been responsible for developing the most successfully commercialised photovoltaic technology internationally throughout the same period. The solar cell technology that is predicted to dominate the market in the next decade (the 'PERC') was invented and developed in our school.

We are looking for excellent students for a novel project involving machine learning and advanced characterization (details below). The PhD project will be run in our state-of-the-art laboratories in **close collaboration with the School of Computer Science Engineering** (CSE). The School of Computer Science and Engineering is **one of the largest and most prestigious computing schools in Australia**. It offers undergraduate programs in Software Engineering, Computer Engineering, Computer Science and Bioinformatics, as well as several combined degrees with other disciplines. It attracts excellent students who have an outstanding record in international competitions.

Suitable students will be awarded a full scholarship for 3.5 years (PhD duration in Australia is 3-3.5 years). The scholarship fully covers the university fees and provides an additional allowance to cover living costs:

Tuition fees: **$45,000** per year

Living allowance: **$27,000** per year

Conference allowance: **$3,000** per conference (to support attending a scientific international conference; at least two conferences during the PhD).

Requirements:

Undergraduate Degree: Bachelor's degree in Computer Science or Computer Engineering with a **graduation GPA above 8 out of 10 or equivalent**.

Master degree: Priority will be given for those who graduated from a Masters by research program, focusing on machine learning, big data, or similar.

Supervision will be done by Associate Professor Ziv Hameiri (SPREE), Prof Arcot Sowmya (CSE), and Prof. Thorsten Trupke (SPREE). For more details please contact **Associate Professor Ziv Hameiri** (ziv.hameiri@unsw.edu.au).

Project details: Machine learning application for luminescence imaging

The aim of this project is to develop machine learning algorithms for analysing luminescence-based images in order to improve the efficiency of solar cells.

Photoluminescence (PL) – the emission of light from a material after the absorption of photons – has been proven to be a very powerful monitoring tool for photovoltaic devices. PL *imaging* was developed at UNSW more than a decade ago. Since the first proof of concept studies in our laboratories, this technology has seen rapid adoption worldwide by researchers and companies and is now one of the most widely used techniques. For silicon devices, PL imaging is frequently used to monitor essential electrical parameters such as minority carrier lifetime, implied open-circuit voltage, diode saturation currents, series resistance, shunt resistance, and pseudo fill factor. The contactless nature of the measurement and the fact that it can be performed even on non-completed devices makes it an ideal tool to investigate various limiting processes within silicon wafers and silicon solar cells. **UNSW has an internationally leading position in the growth of PL as an effective inspection tool for silicon photovoltaics**.

This project will benefit from the large knowledge and experience in SPREE on various PL technologies in **developing new groundbreaking PL-based applications for silicon and non-silicon solar cells**.

The main project aims are to:

- Develop machine learning algorithms to extract various electrical properties for luminescence images of silicon wafers, solar cells, and photovoltaic modules
- Develop machine learning algorithms to improve the reliability of photovoltaics systems
- Develop machine learning algorithms to develop the new generation of solar cells
- Saving the world!