Dark current pattern estimation method

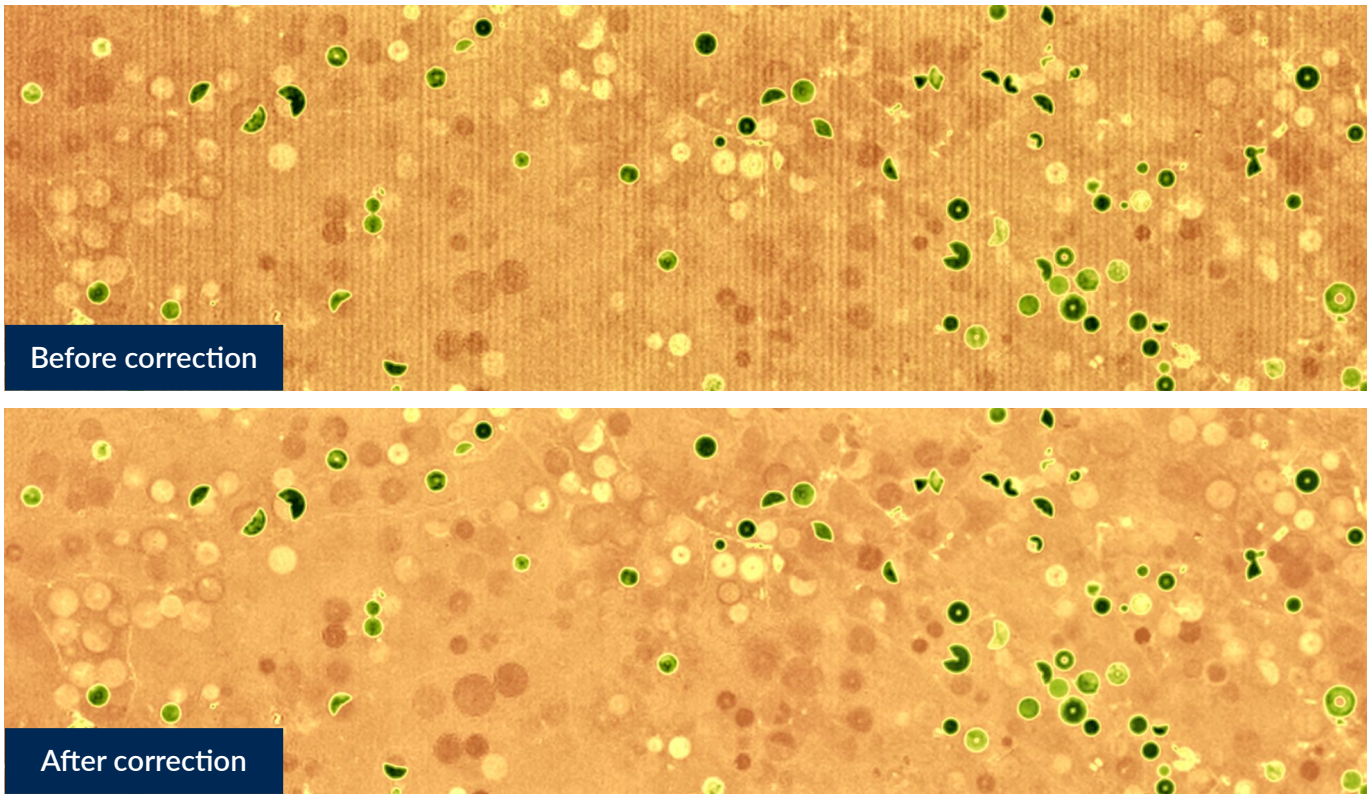
Technology Offer

New method for estimating the background pattern of image sensors **at any operating temperature**, based on laboratory measurements performed beforehand.

Allows **accurate correction of images** in situations where sensor temperature cannot be controlled and mechanical shutters for in-situ calibration are not available.

Simplifies camera operation while enabling **size, weight and power optimizations**.

Example: Vegetation moisture maps taken by space camera based on uncooled InGaAs technology.



NDMI (Normalized Difference Moisture Index) · Sensor temperature: 29.02 °C · Exposure time: 300 µs

Intellectual Property

Patent

Intended collaboration

Licensing or assignment

Stage of development

TRL 9 Validated in three space missions featuring uncooled SWIR (Short-Wave Infrared) cameras

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Market need

Image sensors produce background patterns that need to be corrected in every acquired image. These patterns depend on sensor temperature, among other parameters. Failing to correct them properly could result in images **not meeting the required quality levels**.

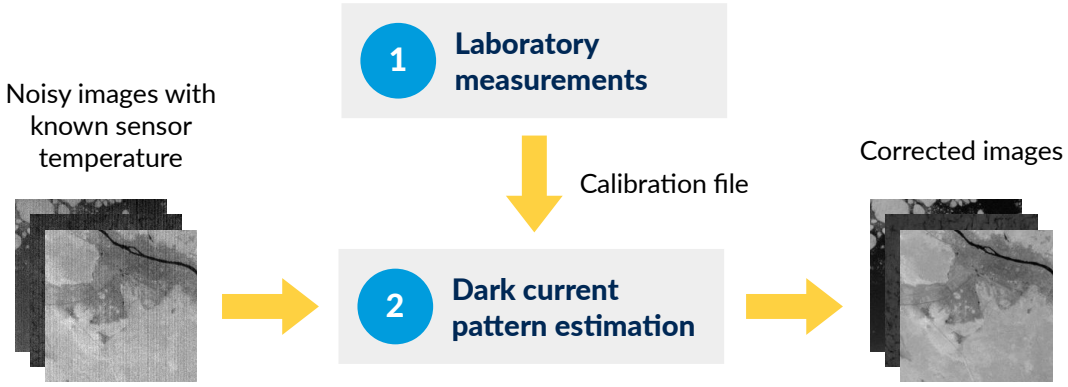
In some sensor technologies like InGaAs, the dependency with temperature is so strong that camera manufacturers have been **forced to add temperature control systems** to stabilize the temperature to some specific value(s), with the associated background patterns measured beforehand in factory or in the field with the help of mechanical shutters.

There are applications where controlling the temperature is **not a feasible solution** due to the limited amount of available power, mass and volume to devote to the temperature control system, specially when the ambient temperature can change rapidly.

Proposed solution

We propose an new method that allows obtaining high quality images by correcting the background patterns of image sensors **at any operational temperature**, thus removing the need of including temperature stabilization systems in cameras where such systems were mandatory.

Cameras integrating this method can benefit from a **significant reduction of power, mass and volume** budgets, as well as from simplified operational requirements. This enables new applications in the **aerospace**, **automotive** and **environmental monitoring** markets, among others.



Competitive advantages

Accuracy Correction performance is comparable to in-situ camera characterization.

Simplicity The algorithm can easily run in an embedded system, such as the camera itself.

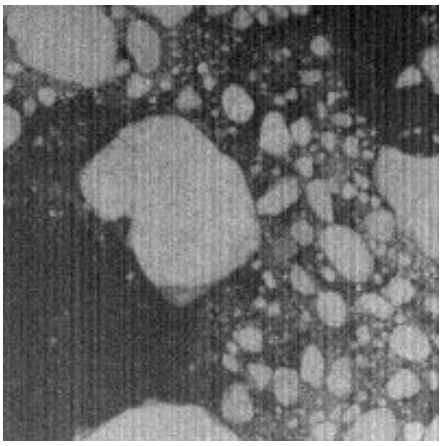
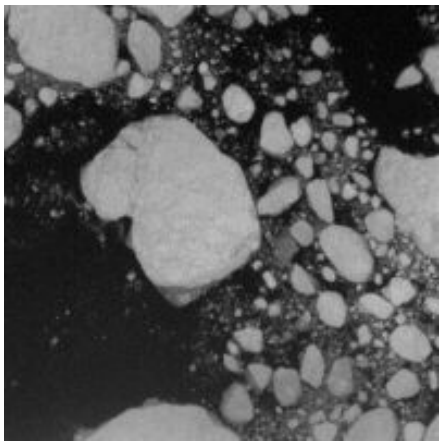
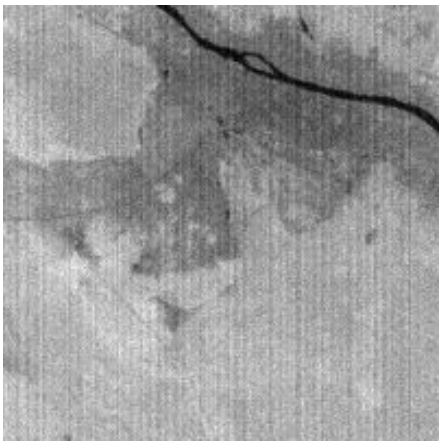
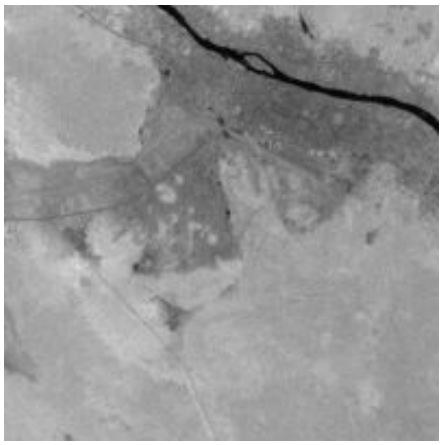
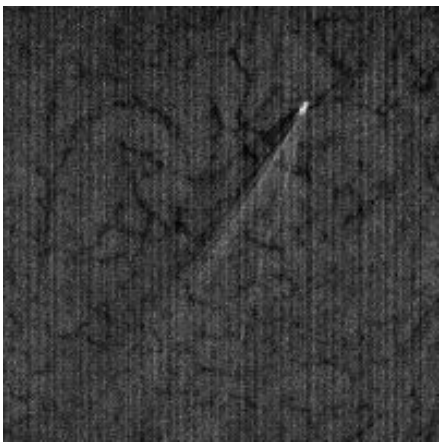
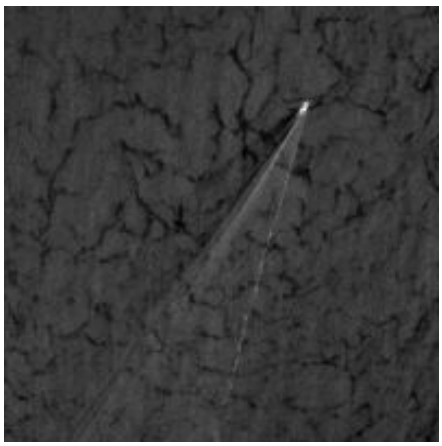
Flexibility Works with any type of sensor, as it does not assume any specific pixel model.

Further examples

The images below have been taken by the DRAGO-2 camera onboard the ALISIO-1 satellite, based on **uncooled InGaAs technology**.

With the proposed method, images can be properly corrected **regardless the acquisition configuration** and **operating temperature**, revealing features that would otherwise be hidden by sensor noise.

DRAGO-2 space camera

Before correction	After correction	
		**Greenland coast** Glacier ice and snow are challenging to image due to their low reflectivities at these wavelengths. λ: 1600 nm · Temp.: 22.08 °C · Exp.: 750 µs
		**Euphrates River** Exposure time was set to simulate the small amount of light that high-resolution satellites can typically gather. λ: 1100 nm · Temp.: 24.29 °C · Exp.: 100 µs
		**Mediterranean Sea** Proper correction of maritime images reveals further details about water texture and ship water trails. λ: 1600 nm · Temp.: 23.35 °C · Exp.: 500 us

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