Internship in ESA's Advanced Concepts Team
On
**Artificial Intelligence Velocimetry for space applications**

European Space Research and Technology Centre
ESA ESTEC

Candidates interested are encouraged to visit the ESA website:
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## Topic Description

Artificial Intelligence Velocimetry [1] is a technique proposed in 2017 wherein a Neural Network is used to reconstruct some flow field given sparse and noisy measurement from an (initially 2D) observational campaign. It was later adapted to use Physics-informed Neural Networks [2,3] and proposed to improve upon Alzheimer's and small vessel disease research. However, the technique seems to be applicable in general to inverse problems where sparse observations are available over a continuous field regulated by a set of partial differential equations. Cases such as satellite fuel sloshing, space propulsion, satellite thermal control, etc. all seem to offer good candidate to apply a similar technique for space research.

## Objectives

The objective of this internship will be mainly three:

1) Propose and detail use cases for AIV in the space context.

2) In one of the proposed cases, propose a specific test case where to apply AIV.

3) Provide and test a first downscaled implementation of the technique over synthetically produced observations.

## Joining the ACT

Creativity and out-of-the-box thinking are essential in the ACT. Therefore, the team is constantly striving to be a diverse, inclusive and equitable workplace bringing together people from various backgrounds. We strongly encourage people from under-represented groups to apply to be part of our team as diversity is central to our mission and core values.

In order to make our hiring as fair as possible, we also ask applicants to not include photos in their CVs.

**References**

[1] Jean Rabault et al, "Performing particle image velocimetry using artificial neural networks: a proof-of-concept", Measu. Sci. Technol. 28 125301, doi: 10.1088/1361-6501/aa8b87 (2017).

[2] Shengze Cai et al, "Artificial intelligence velocimetry and microaneurysm-on-a-chip for three-dimensional analysis of blood flow in physiology and disease", Proceedings of the National Academy of Sciences 118.13 (2021).

[3] Boster, Kimberly AS, et al. "Artificial intelligence velocimetry reveals in vivo flow rates, pressure gradients, and shear stresses in murine perivascular flows." Proceedings of the National Academy of Sciences 120.14 (2023).