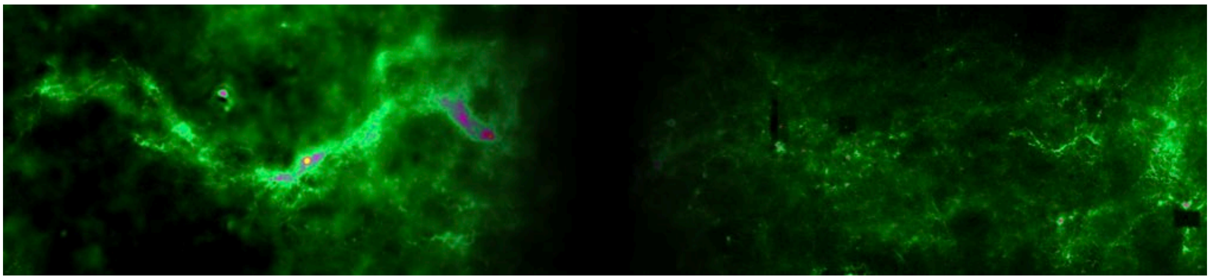

Finding the seeds of new stars—an image analysis challenge

Background

Our home galaxy—Milky Way—continuously gives birth to new stars, some just like our own Sun. But where does this emergence of new stars take place and how does it happen? One of the unsolved mysteries in the lives of galaxies, and in the origin of the Solar system, is how the vast gas reservoirs of galaxies evolve, collapse, and form new stars inside them.

We know today that the new stars form in massive clouds of gas and dust that fill the space between stars. When the physical conditions are favorable, the gas contracts under the influence of its own gravity. This gives rise to small, dense pockets of gas, often called dense cores. These dense cores are where the new stars form—the true seeds of new stars. Therefore, if we wish to understand how new stars form, we must be able to locate the dense cores and study the physical processes taking place in them.

Problem description

Unfortunately, finding the dense cores from astronomical data—images—presents a fundamental problem. The datasets are usually complex, noisy, and large even for computers. This makes handling the data problematic and automated image analysis tools are required. Indeed, image processing and analysis techniques are one key to finding the seeds of new stars from the chaotic gas clouds of the Milky Way.

Work description

We will analyze a new large dataset—a map of molecular clouds in the Milky Way—and apply various image analysis techniques to look for the dense cores in it. This will be achieved by manipulating the data set in various ways and applying methods such as filtering and feature identification. In this work, both students' own programming and existing tools in *Python(/Matlab)* will be used. In addition, we will familiarize ourselves with the basic concepts of how the new stars in the Milky Way come to be.

Target group

Teknisk fysik (TKTFY), Teknisk matematik (TKTEM), and Datateknik (TKDAT). Basic programming skills (for example with *Python*) are necessary.

Group size

3-6 students (max 2 groups).

Teachers/Supervisors

Jouni Kainulainen jouni.kainulainen@chalmers.se
Andri Spilker andri.spilker@chalmers.se

Examiner

Magnus Thomasson magnus.thomasson@chalmers.se

[illegible]