COM-500 Mini-Project
Radio-Interferometric Source Localization

Mini-Project Goals

Each mini-project proposes to deep-dive into one of the statistical signal and data processing tools seen in class.
The general tasks to be executed are:

- Implement the assigned tool (Python or Matlab);
- Test it on simulated and real data. (Real data will be provided.)
- Consult the suggested literature for another tool, not presented in class, outperforming the assigned tool;
- Implement the new tool (Python or Matlab);
- Prepare a demo (on simulated and real data) comparing the tools;
- Prepare $\simeq 5$ slides to present the tools to the class, how they compare, and a demo.

You will be evaluated on these tasks.

Mini-Project Description

Radio-Interferometry (RI) is a common tool in astro-physics to locate stars and quantify their intensity by analyzing stellar radiation captured by radio-telescopes. The forward model in RI is identical to that of far-field acoustics; however parametric estimation methods such as MUSIC are unheard of in RI.
The goal of this project is to gain insight into why such methods are shunned in RI by comparing the positioning accuracy of different parametric and non-parametric estimation methods for a given radio-telescope. You will also assess the resilience of these methods to source model mismatch.

References

- H. Krim, M. Viberg (1996). Two decades of array signal processing research: the parametric approach. IEEE signal processing magazine, 13(4), 67-94.
- M. Simeoni (2015). Towards more accurate and efficient beamformed radio interferometry imaging.
- M. Simeoni (2016). Attributing Aliasing Artifacts in Dirty Intensity Fields to their Parent Source.
- S. Kashani (2017). Towards Real-Time High-Resolution Interferometric Imaging with Bluebild.