Palina Salanevich (Utrecht University)

PtyGenography: generative priors as regularizers for the phase retrieval problem

Abstract: In phase retrieval and similar inverse problems, the stability of a solution under different noise levels is crucial for practical applications. To address instabilities, one often employs regularization techniques. However, Tikhonov and other conventional regularizers tend to smooth out high-frequency components, which can be problematic when trying to capture detailed features of a signal. Recently, generative models have emerged as a powerful alternative, allowing the incorporation of prior information on the signal into the problem and thereby enhancing reconstruction stability. The rationale here is that the conditioning of the composition of the generative model and the measurement map is more favorable than that of the measurement map alone, albeit at the cost of introducing a bias in the reconstruction. It has indeed been observed in numerical experiments that for high signal-to-noise ratio, the conventional reconstruction model performs better, while in the case of low signal-to-noise ratio, the generative reconstruction model outperforms it. In this talk, we will explore and compare the reconstruction properties of classical and generative inverse problem formulations and propose a new unified reconstruction approach that mitigates overfitting to the generative model for varying noise levels.
The talk is based on the joint work with Selin Aslan, Tristan van Leeuwen, and Allard Mosk.