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Generative models for Inverse Problems: The phase retrieval problem from a single distance intensity measurement

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The phase retrieval problem is a non-linear, ill-posed inverse problem. It is also an important step in X-ray imaging, a precursor to the tomographic reconstruction stage. Experiments involving micro and nanometer-sized objects usually have weak absorption and contrast. This is usually the case in most experiments taking place at high-energy big Synchrotron centres like DESY. Hence, retrieving the phase information is crucial for the quality of the tomographic reconstruction. This problem exists also in other fields like astronomy, optics, and electron microscopy. Our research deals with single distance, near or holographic region intensity images, which, in the mathematical sense, are the squared modulus of a complex object that was propagated forward to a certain distance using the Fresnel operator. In this talk, we want to challenge the listeners that generative models can be powerful tools in inverse problems, especially those with clearly defined forward models. We would further show that it plays an important role in uncertainty quantification.

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