摘要：

无透镜显微成像是显微成像领域的一个重要角色，由其成像原理，我们需要从像面的感光元件采集的亮度图像（我们称为全息图）重构波前相位信息，进而对物面进行振幅或相位成像，其中涉及到了相位恢复问题。近些年来出现了一些使用深度学习方法代替传统算法进行相位恢复的工作，但是，其中大部分的研究更倾向于使用单次测量的全息图进行相位恢复，不可否认的是，这种方法的确降低了采集系统的机械结构的复杂度，但是在这种低约束下，无论是传统算法还是使用神经网络的深度学习方法，其相位恢复效果都不令人满意，难以达到实用的标准。在本文中，我们提出了一种针对不同离焦距离下多帧采集的用于无透镜显微成像相位恢复的网络，针对多帧采集的全息图，我们的将网络设计为一种解耦-融合结构，这种结构的优点在于，网络可以自由的拆分和组装，以应对硬件系统发生变化带来采集帧数的改变，但同时可以保留网络原先学习到的先验信息。本文中，我们将展示实验结果证明我们的网络在相位恢复任务中展现的优异性能，以及良好的泛化能力。另外我们的网络基于自监督学习，无需获取真实标签。

Lens-free microscopic imaging is an important role in the field of microscopic imaging. Based on its imaging principle, we need to reconstruct the phase information of the wave front from the brightness image collected by the photosensitive element of the image plane (called hologram), and then carry out amplitude or phase imaging of the object plane, which involves phase recovery. In recent years there have been some deep learning method is used instead of traditional algorithm of phase recovery work, however, most of the studies are more likely to use a single measurement of restoring the phase holograms, undeniably, this method is to reduce the complexity of mechanical structure of acquisition system, but in this lower bound, Neither the traditional algorithm nor the deep learning method using neural network has satisfactory phase recovery effect, which is difficult to reach the practical standard. In this article, we put forward a different multiple frames from the focal distance of the acquisition of network for no lens microscopic imaging phase recovery, in view of the hologram multiframe collection, our network design is a kind of decoupling - fusion structure, this structure has the advantage that the network can be split and assembly of freedom, in response to a hardware system change brings the change of sampling frames, But at the same time, the prior information learned by the network can be retained. In addition, we demonstrate the excellent performance and good generalization ability of our network in phase recovery task. Our network is based on self-supervised learning without obtaining real tags.