**Accurate phase retrieval of complex 3d point spread functions with deep residual neural networks**

**带有深度残差神经网络的复杂3d点扩散函数的精确相位检索**

1.在Direct determination中哪里提到该文章

In microscopy, ANNs are beginning to find use in both indirect[23–25] and direct aberration sensing methods[26–28].

The tendency of PSFs to approach a uniform diffraction limited shape means that the prediction ability of the ANN is hindered at low aberration function magnitudes, a characteristic which may be mitigated by the use of additional PSF images [28].

2.该文章逻辑是什么

Introduction

波前信息+相位信息都很重要

目前主要用相位检索，对计算要求高，相对较慢，需要大量附加信息

目前深度神经网络可以被应用于相差识别

仅需一组PSF即可识别

PSF simulations

选择了五个离焦/在焦点上的面

Network architecture

增加训练集，200000个

简单的卷积神经网络无法很好地识别

因此利用残差神经网络进行解决

残差神经网络介绍

利用器材

Results

预测结果较为准确

在无噪声训练上较好

检索与目前的神经网络结果对比

相应训练集需要更广

有鲁棒性

Conclusion

3.该文章核心是什么？

该文章利用深度残差神经网络，取了n组五个in-focal和out-of-focus PSF图像作为训练集还原Zernike多项式信息并与目前的相位检索方法较为匹配。不过值得注意的是，需要使用的训练数据集量非常大（看一位PSF图片较多），100000左右。

4.英语表达该文章核心

This article uses a deep residual neural network to take several sets of five in-focal and out-of-focus PSF images as training sets to restore Zernike polynomial information and the result matches the current phase retrieval method. However, we should notice that the amount of training data set that needs to be used is very large (may be there are lots of PSF images), about 100,000.