**Deep-STORM: super-resolution single-molecule microscopy by deep learning**

**Deep-STORM：通过深度学习的超分辨率单分子显微镜**

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].

2.该文章逻辑是什么

INTRODUCTION

目前显微镜的发展及相关的功能

目前挑战，高密度的PSF如何分辨，目前困难是需要多次迭代而且需要反复调试参数

在文章中，展示了精确快速无参数的超分辨率图像重建，且算法更快

METHODS

接收一组发射器图像，返回一组超分辨率图像

A. Deep Learning

1. Architecture

基于CNNs架构，所用激活器

2. Training

训练规格及内容

3. Loss Function

定义平方距离及惩罚数

实验结果及代码

B. Microscopy

实验器材

RESULTS

实验结果的具体数据

生成及训练过程

发现的问题

对比验证试验速度的加快

DISCUSSION

表明卷积神经网络有较高的鲁棒性

该技术十分灵活而且无需专业性

3.该文章核心是什么？

这篇文章利用deep-storm卷积神经网络，在高密度发射器下仍然能够得到超分辨图像，省去了传统的不断调整参数的烦恼。

4.英语表达该文章核心

This article uses the deep-storm convolutional neural network to obtain super-resolution images under high-density emitters, eliminating the traditional troubles of continuously adjusting parameters.

5.积累的问题

Strehl ratios

Strehl ratio：艾里斑内聚光强度比

RMS magnitude 在π情况下 均方差大小

<https://www.telescope-optics.net/aberrations.htm>

<http://www.astronomycorner.net/notes/strehl.html>

<https://www.telescope-optics.net/Strehl.htm>

<https://wenku.baidu.com/view/6eaca0fde43a580216fc700abb68a98270feac7f.html>

PSF

https://blog.csdn.net/weixin\_39750861/article/details/84556204

<https://blog.csdn.net/miscclp/article/details/7456470>

<https://blog.csdn.net/weixin_40300818/article/details/86794116>

<https://bitesizebio.com/22166/a-beginners-guide-to-the-point-spread-function-2/>

<http://web.ipac.caltech.edu/staff/fmasci/home/astro_refs/PSFtheory.pdf>

<https://wp.optics.arizona.edu/jcwyant/wp-content/uploads/sites/13/2016/08/psfandmtfcurves.pdf>

<https://www.mathworks.com/matlabcentral/answers/343558-point-spread-function-of-an-optical-system>

Zernike

<https://baike.baidu.com/item/Zernike%E5%A4%9A%E9%A1%B9%E5%BC%8F/2735195?fr=aladdin>

<https://en.wikipedia.org/wiki/Zernike_polynomials>

<http://www.dm.unibo.it/home/citti/html/AnalisiMM/Schwiegerlink-Slides-Zernike.pdf>

<https://www.opt.indiana.edu/vsg/library/vsia/vsia-2000_taskforce/tops4_2.html>

<https://wenku.baidu.com/view/f92e4346a8956bec0975e3d9.html>

<http://xuebao.jlu.edu.cn/gxb/article/2014/1671-5497-44-6-1860.html>

<https://blog.csdn.net/qq_26898461/article/details/47123009>

<https://blog.csdn.net/piaoxuezhong/article/details/65444605>

<https://www.cnblogs.com/chensheng-zhou/p/5054354.html>

<http://wyant.optics.arizona.edu/zernikes/Zernikes.pdf>

<https://wp.optics.arizona.edu/jsasian/wp-content/uploads/sites/33/2018/04/Schwiegerling-Zernike-2018.pdf>

<https://telescope-optics.net/zernike_aberrations.htm>

<http://jan.ucc.nau.edu/jmn3/students/zernike.pdf>

<http://paristech.institutoptique.fr/site.php?id=562&fileid=6769>

<https://www.gatinel.com/recherche-formation/wavefront-sensing/zernike-polynomials/>

<https://www.telescope-optics.net/zernike_aberrations.htm>

像差补偿aberration compensation

<https://www.edmundoptics.com/knowledge-center/application-notes/optics/an-in-depth-look-at-spherical-aberration-compensation-plates/>

<https://optics.org/news/10/8/6>

波前传感器- Shack-Hartmann型

<https://zhidao.baidu.com/question/102215035.html>

<https://www.thorlabs.com/newgrouppage9.cfm?objectgroup_id=5287>

<http://www.astrosurf.com/cavadore/optique/shackHartmann/Shack-Hartmann.htm>

<http://www.optics.arizona.edu/sites/optics.arizona.edu/files/pdf/Historical-Development-Shack-Hartman-Wavefront-Sensor.pdf>

<https://www.rp-photonics.com/shack_hartmann_wavefront_sensors.html>

剪切干涉仪shearing interferometer

<https://www.thorlabs.com/newgrouppage9.cfm?objectgroup_id=2970>