**Adaptive optics for array telescopes using neural-network techniques**

**神经网络在自适应光学阵列望远镜的应用**

1.在Direct determination中哪里提到该文章

In adaptive optics, deep learning was initially applied to astronomical telescopes [18–20]

2.该文章逻辑是什么

第一段讲述相控阵列望远镜，如果阵列元件不大，可以充分矫正波前误差

第二段简要介绍了几个例子

第三段介绍Strehl ratios

第四段红外波长优势

第五段目前瓶颈

第六段复杂的处理方法

第七段没有用的老方法

第八段新兴的神经网络处理像差恢复波前的办法可行

第九段波前像差检索有用，但是针对极端非线性，一般波前无法恢复

第十段神经网络的原理不清楚，但非常强大

第十一段实验方法

第十二段神经网络训练过程

第十三章训练目标

第十四章训练结果与设想对比

第十五章定量比较

第十六章噪声不会影响神经网络工作

3.该文章核心是什么？

本文优化出适用于红外波长成像的神经网络，该网络利用一对聚焦和离焦的图像，可以导出和预测阵列元件之间的光程和wavefront tilt的变化。

4.英语表达该文章核心

This article optimized a neural network appropriate for infrared wavelengths imaging with a pair of simultaneous in-focus and out-of-focus images, which can derive and predict variations in pathlength and wavefront tilt between array elements.

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>