**Comparative Study of Neural Network Frameworks for the Next Generation of Adaptive Optics Systems**

**下一代自适应光学系统的神经网络框架的比较研究**

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] and has recently been revisited with the advent of modern architectures [21,22].

2.该文章逻辑是什么

Introduction

简要介绍自适应光学系统及作用

目前的进展

新型的Multi-object adaptive optics，CARMEN

机器学习在AO方面的优势

过去几年的发展以及与其他网络框架对比的原因

介绍文章框架

Adaptive Optics Systems

介绍Shack-Hartmann Wave-front Sensor，分为阵列小块，倾斜处理像差

继续介绍SHWFS，介绍原理

介绍多目标的自适应光学系统

简要图例介绍了自适应补偿波前的开环系统

介绍多目标光学自适应系统CANARY

介绍更复杂的DRAGON

总结并提出需要关注一个可安装在GPU中的AO系统

CARMEN Architecture

介绍CARMEN网络

网络大小可变

获得结果与示意图

对比CANARY与DRAGON

Overview of Neural Network Framework

介绍目前主流的神经网络框架

Caffe

Torch

Theano

C/CUDA

目标为尽可能轻便

介绍了CARMEN中使用的内容

Experiment Description

简要介绍如何比较框架

CARMEN在过程中的目的

Training Benchmark

简介参数

学习速度+momentum

训练数据大小

三个不同网络在不同参数下比较

训练与计时方法对比

Execution Benchmark

培训基准的差异

输入网络单一

Caffee的特殊要求

写入时间假设

Theano的特殊要求

输入数量

Experiment Equipment

试验设备具体介绍

Results

简介不同系统

CANARY-B1

对比不同批量所需时间与所用代码不同，主推CUDA

CANARY-C2

对比不同批量所需时间与所用代码不同，主推CUDA

DRAGON

对比不同批量所需时间与所用代码不同，主推CUDA，但时间上很相近

Discussion

对于小型网络，不同方法差距很大

对较大网络，性能差异较小

推C/CUDA code

Conclusions and Future Lines

推C/CUDA code

展望未来

3.该文章核心是什么？

本文分析了基于大小不同的人工神经网络的断层摄影波前重建器的训练和对比执行了不同框架，从而避免了无用的计算并提高了计算效率。C/CUDA code深受推崇

4.英语表达该文章核心

This article analyses different frameworks for training and executing of a tomographic wave-front reconstructor based on small or huge artificial neural networks to avoid useless calculation and improve the calculating efficiency. C / CUDA code is highly respected.

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>