



# 新加坡南洋理工大学

## 人工智能学术及科研论文项 目

哈尔滨工业大学（威海）

# 目录

一、	项目概览.....	3
二、	项目介绍.....	4
三、	导师背景.....	9
四、	项目设置.....	10
五、	项目成果.....	12

# 新加坡南洋理工大学 人工智能科研论文项目

(南洋理工大学科研结业证明、推荐信、科研评定报告、国际论文)



## 一、项目概览

**项目主题：** 人工智能学术及科研论文项目

**项目背景：** 本科研项目主要面向对人工智能等领域感兴趣的学生，科研内容包括但不限于机器学习、深度学习、神经网络、图像处理及识别等人工智能领域前沿技术。依托新加坡南洋理工大学商业人工智能实验室（NTU Business AI Lab），学员将以小组形式，跟随实验室主任进行相关课题的科研，在导师的指导下，完成科研报告，并形成符合 IEEE 国际规范的科研论文。

**项目历史：** 本科研项目自启动以来，已成功举办 13 期，共 800 余位优秀大学生参与并受益。往期学员来自武汉大学、北京邮电大学、重庆邮电大学等。往期学员的优秀科研论文、科研海报，有成功发表在南洋理工大学官网、IEEE 会议论文集。

**南洋理工大学简介：** 南洋理工大学（NTU），是新加坡的一所世界著名研究型大学。NTU 是环太平洋大学联盟、新工科教育国际联盟成员，全球高校人工智能学术联盟创始成员、AACSB 认证成员、国际事务专业学院协会（APSIA）成员，也是国际科技大学联盟的发起成员。作为新加坡的一所科研密集型大学，其在纳米材料、生物材料、功能性陶瓷和高分子材料等许多领域的研究享有世界盛名，为工科和商科并重的综合性大学。2022 QS 世界大学排名第 12 位；2022 QS 亚洲大学排名第 2 位。



## 二、项目介绍

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项目时长： 6周，17小时。

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授课日期 2022年07月-2022年09月

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科研实习模式： 线上（直播：Zoom）

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科研项目工具： Python 编程语言、Rstudio, Weka, Jupyter, Colab, Anaconda

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### 项目收获：

完成科研项目的学员，将有以下可预期的收获：

1. 南洋理工大学主办部门商学院商业人工智能实验室官方颁发的**科研结业证明**
2. 南洋理工大学导师签发的**导师推荐信**
3. 南洋理工大学主办部门商学院商业人工智能实验室官方颁发的**科研学术评定报告（不含学分）**
4. 南洋理工大学主办部门商学院商业人工智能实验室官方颁发的**优秀科研小组嘉奖信**
5. 一篇符合 IEEE 国际标准的科研论文



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结业证明（样本）

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23 March 2021,

**COMMENDATION LETTER**

To whom it may concern,

It is my great pleasure to confirm that CHAOHUA SHI has participated in the Artificial Intelligence Internship Programme in NTU Business AI Lab from 23 January to 28 February 2021.

During the programme, CHAOHUA SHI was a member of the team who won the final project presentation. The winning team succeeded in presenting creative and useful ideas and insights on the project and CHAOHUA SHI especially emerged as a contributing member of the winning team in the project competition which took place at the end of the programme.

We have previously worked with many international students from all over the world, and CHAOHUA SHI was amongst the top students within their group, with the potential of achieving great things as student or entrepreneur in the future.

We wish this student the best for the future.

Yours faithfully,



Prof. Teoh Teik Toe  
+65 97905202  
tsteoh@ntu.edu.sg  
Associate Director, NTU Business AI Lab  
Nanyang Technological University



**Programme Name:** Artificial Intelligence Internship Programme

**Programme Date:** 23 January to 28 February 2021

**Hosted Online by:** Nanyang Technological University, Business AI Lab

BOWEN ZHU has successfully completed the Artificial Intelligence Internship Programme which comprised a series of discussions, assignments as well as a group project.

**Overall Grade: Distinction**

*A **fail** is given when the participant has not met the programme's objectives. The participant missed to attend all courses, to show enough effort and achievement in both academic course and assignments.*

*A **pass** is given when the participant has met the learning objectives and reached the expected outcomes. The participant has completed the whole programme, submitted assignments in due time.*

*A **merit** is awarded when the participant has fully participated in the programme, both in academic course and assignments. The participant has taken part in a team project and has contributed to the presentation of the project.*

*A **distinction** is awarded when a participant has taken a leading role in the course, has been interactive and has demonstrated a high capacity to understand and converse in English. This is a special award for outstanding performance and an encouragement to others.*

This programme was delivered in English online with 22 academic hours.

To whom it may concern,

I am writing this letter of recommendation for the quality of work displayed by BOWEN ZHU during his internship in NTU Business AI Lab. He has helped to develop some AI models based on a dataset given. In addition, he has also compared numerous models using WEKA. I am deeply impressed by his work attitude and quality.

BOWEN ZHU has displayed excellent communication skills throughout my interactions with him. In addition, he is thoroughly organized, reliable and possess high domain knowledge in the field of Artificial Intelligence (AI). He is bright, hardworking and has a positive attitude that makes him a pleasure to work with.

BOWEN ZHU is able to complete the work assigned to him independently. He is also able to follow through the jobs assigned to him and complete them with high quality without any form of delay. He is highly flexible and is willing to work on any projects assigned to him.

BOWEN ZHU would be a tremendous asset for any organization or further study at higher degree and I highly recommend him. If you have any further questions, please do not hesitate to contact me.



Prof. Teoh Teik Toe  
+65 97905202  
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Associate Director, NTU Business AI Lab  
Nanyang Technological University

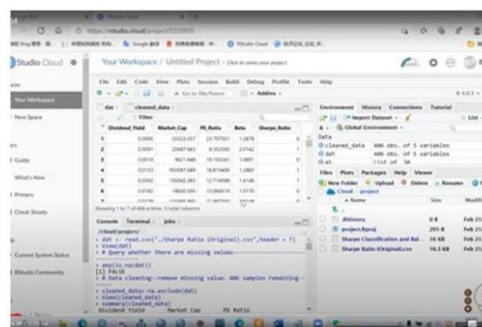
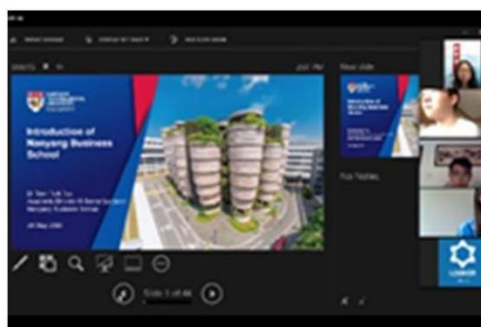
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### 优秀科研小组嘉奖信（样本）

#### 科研专业课及辅导课：

在专业课与辅导课上，导师会一边讲授专业知识，一边带领同学们进行实践操作，并且各位同学的成果也会及时和导师进行分享，在六周的学习期间，导师带领同学们学习了人工智能领域的丰富知识，包括决策树、回归分析、神经网络、Power BI、Weka、长短期记忆、语音识别、聊天机器人、语言处理、图像处理、区块链、强化学习等等。导师更是非常耐心地给予每位同学充分的指导，确保各位同学都能够掌握课堂学习内容，并进行实践操作。

除了每周的专业课程与辅导课程上的专业教学与指导，导师还安排了自己的助教，为有问题的同学进行课后的辅导。如果同学们在某个实践环节遇到问题，不能顺利进行操作，或者在结业任务准备中遇到任何困难，助教老师会针对每位同学们的情况，进行一对一的辅导，帮助每位同学解决自己在学习遇到的问题。助教老师在学习环节中也给到了同学们非常大的帮助，通过这种形式，使得每位同学都能够在知识的海洋中尽情地研究学习，并在遇到问题时获得指导。



<b>考核方式:</b>	课程出勤	个人	30%
	小组作业	小组	40%
	最终作业	个人	30%
	合计		100%

**人均费用** 2834 元/人（哈尔滨工业大学（威海）暑假特别定制团价格）

**成班人数** 35 人

**授课语言** 英语

- 后勤服务**
- 配备一名专属班主任，全程协调学生学习情况；
  - 组织课程微信沟通群；
  - 协助学生调试线上课程平台软件；
  - 协助教授发放课程资料；
  - 跟踪学生课程学习效果。



### 三、导师背景

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项目导师:	<b>Dr. Teoh Teik Toe</b> <ul style="list-style-type: none"><li>• 南洋理工大学商业人工智能实验室，执行主任</li><li>• 南洋理工大学商学院，商业分析硕士课程主任</li></ul>
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学术背景:	<b>背景概要:</b> <ul style="list-style-type: none"><li>• 南洋理工大学，商业人工智能实验室，执行主任</li><li>• 新加坡设计科技大学（SUTD）副主任、SUTD Academy 院士</li><li>• 25 年研究与软件开发经验</li><li>• 13 年教学经验</li><li>• 论文发表：41 篇 (14 篇期刊论文、25 篇会议论文、2 篇专书论文)</li><li>• 谷歌学术 H 指数：4</li><li>• 新加坡设计科技大学创业公司（Luminaire、Luxury Mystery）联合创始人</li></ul> <b>教育背景:</b> <ul style="list-style-type: none"><li>• 南洋理工大学，计算机工程博士学位</li><li>• 新加坡技术设计大学，博士</li><li>• 南加州大学，计算机工程学硕士，电气工程（荣誉）学士</li></ul>
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研究兴趣:	<b>2016</b> <ul style="list-style-type: none"><li>• 人工智能：网络安全实验室深度学习</li><li>• 项目：通过 Weka、Matlab 和 Python 的机器学习/深度学习分析大数据、高速网络安全</li><li>• 计算模式：Fuzzy、K-mean、PCA、MLP、Ngram、HMM、递归神经网络、LSTM、CNN</li></ul> <b>2006 - 2012</b> <ul style="list-style-type: none"><li>• 自闭症检测：使用包括自组织图在内的模糊神经网络开发一个计算模型，以使用 Weka、Visual Basic 和 Matlab 检测自闭症</li><li>• 人脸检测：用神经网络、多层感知器、决策树、朴素贝叶斯、SVM，Kmean 和 KNN 在 Weka、Visual Basic、Matlab、C++和 C# 的计算机和手机中进行开发</li><li>• 人脸识别：用神经网络、多层感知器、朴素贝叶斯、Kmean、KNN 在 Weka、Visual Basic、Matlab、C++和 C# 的计算机和手机中进行开发</li><li>• 情绪识别：使用模糊神经网络、遗传算法、Hidden Markov 来开发计算模型，以使用 Weka、Visual Basic、Matlab 识别人的情绪</li></ul> <b>2006 - 2012 新加坡科技局-开发游泳池淹没检测、图像压缩</b> <b>新加坡教育部- 操作软件</b> 电子商务、酒店软件、SMS 网关、学校财务系统、计算机跟踪监控系统、总体运行数据和报告软件、库存管理、客户关系管理、资产跟踪，考勤系统、访客跟进、销售代理管理
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南洋理工大学讲授课题:	<ul style="list-style-type: none"><li>- AN6001 人工智能与大数据</li><li>- AN8002 人工智能与高级预测技术</li><li>- AN8008 深度学习与现代人工智能</li></ul>
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## 四、项目设置

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第一周 专业课 (1) 欢迎致辞  
2 小时

**科研主题：深度学习与 Python 编程**

**科研内容：**

- 什么是深度学习
- 面向对象编程及其优缺点
- Python Institute 的 PCAP 认证
- 数据结构（堆栈，数组，数据帧）

**科研作业：**通过 Python 进行对数据进行结构化处理

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辅导课 (1) 科研作业辅导、答疑、知识补充  
1 小时

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第二周 专业课 (2) **科研主题：基于计算机视觉技术的图像处理**  
2 小时

**科研内容：**

- 图像的直方图和均衡器分析
- 图像的色彩分析
- 图像的亮度分析
- 标准化以帮助图像分类
- 对图像进行变换：傅立叶变换

**科研作业：**使用计算机视觉对图像进行处理

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辅导课 (2) 科研作业辅导、答疑、知识补充  
1 小时

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第三周 专业课 (3) **科研主题：深度学习的神经网络**  
2 小时

**科研内容：**

- 感知器概念：神经网络的基础
- 神经网络的激活函数—线性和非线性
- 分类与回归
- 虚拟变量与一种热编码
- Keras 深度学习库与 TensorFlow 机器学习资源库

**科研作业：**使用多层感知器 (MLP) 对数据进行分类和结构化处理

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辅导课 (3) 科研作业辅导、答疑、知识补充  
1 小时

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第四周 专业课 (4) **科研主题：基于卷积神经网络 (CNN) 的图像识别**  
2 小时

**科研内容：**

- 滤波器 (Filter) 与卷积核 (Kernel)，用途和应用
- 卷积神经网络的设计，Filter 的层数和数量，包括 maxpool
- 例如 AlexNet 和 ResNet 的流行模型
- 平展卷积与多层感知器 (MLP)

**科研作业：**使用卷积神经网络进行图像分类

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辅导课 (4) 科研作业辅导、答疑、知识补充  
1 小时

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第五周 专业课 (5) **科研主题：人工智能论文写作**  
2 小时

**科研内容：**

- 摘要
  - 文献评论 (最少三篇)
  - 数据准备及实验设定
  - 建议的模型
-

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- 测试结果
  - 对提交给 IEEE 的报告进行格式化
- 科研作业：**按照 IEEE 格式准备论文
- 

**辅导课 (5)** 科研作业辅导、答疑、知识补充  
1 小时

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**第六周 专业课 (6)** **科研主题：IEEE 会议论文提交**  
2 小时 **科研内容：**

- 会议选择-IEEE 中国或国际
- 会议论文提交
- 会议海报的准备
- 同行评审反馈和修改

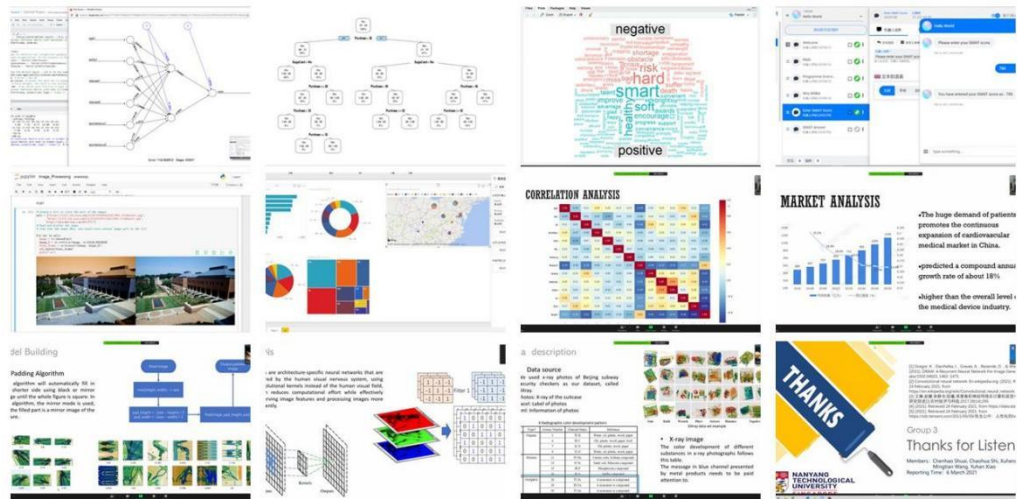
**科研作业：**形成符合 IEEE 规范的人工智能科研论文

**项目总计、结业致辞**

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备注：以上为参考日程安排，实际课程安排可能会根据老师情况略有调整。





# 2022 IEEE 7th International Conference on Intelligent Computing and Signal Processing (ICSP 2022)

04/15/2022 - 04/17/2022 Xian • China

## Acceptance Letter

Dear Author(s):

Congratulations! Your manuscript has passed the peer review (the reviewers' comments are available in the attached file on AIS) and has been accepted by the 2022 IEEE 7th International Conference on Intelligent Computing and Signal Processing (ICSP 2022). The conference will be held in Xian • China from 04/15/2022 - 04/17/2022. We are glad to invite you to attend the conference and make an oral report.

**Manuscript No.:** U2YQJYBYKZ

**Author name(s):** Zhichao HU

**Manuscript title:** The optimization of CNN fruit recognition based on Dbscan and SLIC algorithm

Your manuscript, after presented in the oral report or poster in the conference, will be published on IEEE, after which it will be submitted for index in IEEE Xplore, EI Compendex, Scopus.



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# The optimization of CNN fruit recognition based on Dbscan and SLIC algorithm

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**Abstract**—In the era of big data, with the development of digital management and distribution, it is inevitable to improve the degree of intelligence in agricultural industry. Therefore, the recognition and classification of agricultural products like fruit is requiring optimization. In this paper, the CNN fruit recognition system is built for recognizing different types of fruits and reclassifying each recognized fruit to the corresponding labels. Two algorithms are used for improving the accuracy of this system. According to the feature extractions of the original images of fruits, Dbscan algorithm preprocessing focuses on the shape of fruits by separating the main body of fruit from the background, and SLIC algorithm preprocessing enhances the LAB value of image by clustering the pixels in the super-pixel color blocks.

**Keywords**—CNN fruit recognition system, Dbscan algorithm preprocessing, SLIC algorithm preprocessing, BP, super-pixel color blocks

## I. INTRODUCTION

In recent years, artificial intelligence has been integrated into life and convenient services can be seen everywhere with the rapid development of technology. Alibaba Group Holding LTD's Alipay and Tencent Group's wechat Pay have both freed consumers from cash and credit cards by using their phones to make payments through a QR code, a fingerprint or facial features on the screen. The application of smart city enables urban traffic systems to easily grasp map data and intelligently analyze vehicle data, so as to control traffic lights globally in the city and significantly improve the speed of vehicles in congested cities. In addition, there are smart watches people wear at ordinary times and sweeping robots at home, etc.

The computer vision and deep learning are eye-catching branches of artificial intelligence nowadays. Image recognition as an important part of computer vision task, its development has been the focus of scholars in our country and abroad, and image as the most important form of unstructured data in the era of big data, is the main way of information exchange between human beings and the outside world[1]. Massive amount of image information permeates into every aspect of our life. How to quickly screen out the most valuable part of the massive amount of information for our use is a hot topic at present and also an urgent problem to be solved[2].

Taking the recognition and processing of fruit image as an example, fruit recognition and classification technology plays

an important role in fruit cultivation, marketing, digital medical treatment and other aspects. In terms of planting research, fruit recognition technology is applied to smart agriculture and smart city[3]. Fruit trees in compound orchards are precisely cultivated and refined management of fruit trees and automatic picking of fruit are realized through fruit recognition technology. Tao et al. adopted variable recognition technology to realize color recognition of apple and potato[4], Blanc designed a classification system that can grade clusters of fruits similar to grapes[5], and Baigvand et al. designed a complete classification system that realized the classification of dried figs[6]. It greatly reduces the labor cost and solves the long cycle of manual classification. In terms of fruit sales, supermarkets and wholesale markets for edible agricultural products have a wide variety of fruits and huge trading volume. However, at present, most supermarkets and fruit markets still use the traditional manual operation in the trading process of edible fruit. In the sales process, it is necessary to manually judge and identify the type of fruit, and then manually input the corresponding type number to calculate the amount[7]. This method not only exists the risk of human operation error, but also consumes manpower, increases labor intensity and affects operating costs. The application of fruit recognition technology can help supermarkets and wholesale markets to realize self-purchase and automatic settlement. In terms of digital medicine, accurate identification of fruit types and analysis of the nutritional components can help nutritionists make more accurate dietary collocation and rehabilitation plans for patients in later recovery.

Therefore, the research on fruit image recognition, classification and processing has a very broad prospect. It is also of great significance to the development of various industries. At present, there are many models and algorithms for fruit recognition, such as: The fruit recognition system based on BP neural network[8], the fruit recognition system design based on TensorFlow[9], the fruit recognition research based on the fusion of multi-classifier DS evidence theory[10], etc. In order to solve the defect of the traditional fruit image classification recognition algorithm to extract features manually, convolutional neural network has been applied to fruit image recognition[11].

This paper aims to study fruit recognition system based on deep learning and construct convolutional neural network. Through DBSCAN algorithm and SLIC algorithm, the trained

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导师寄语:

Dear All, thank you for all your hardwork in the last few weeks. It was not easy. I hope you have learnt something and hope the experience can help you in your future. Please remember your final project and let me know if you are facing any problem. Also please keep in touch.

-- Dr. T.T. Teoh, Associate Director, NTU Business AI Lab

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