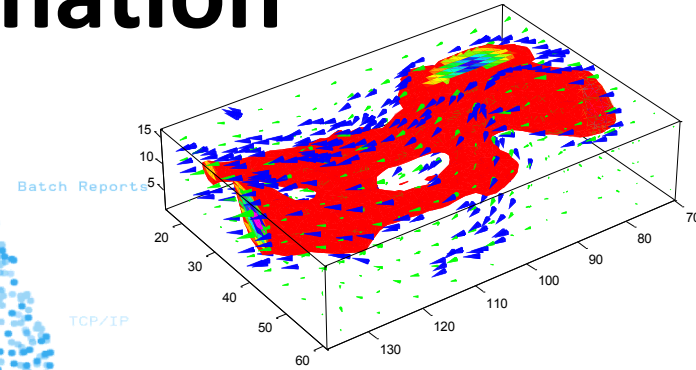
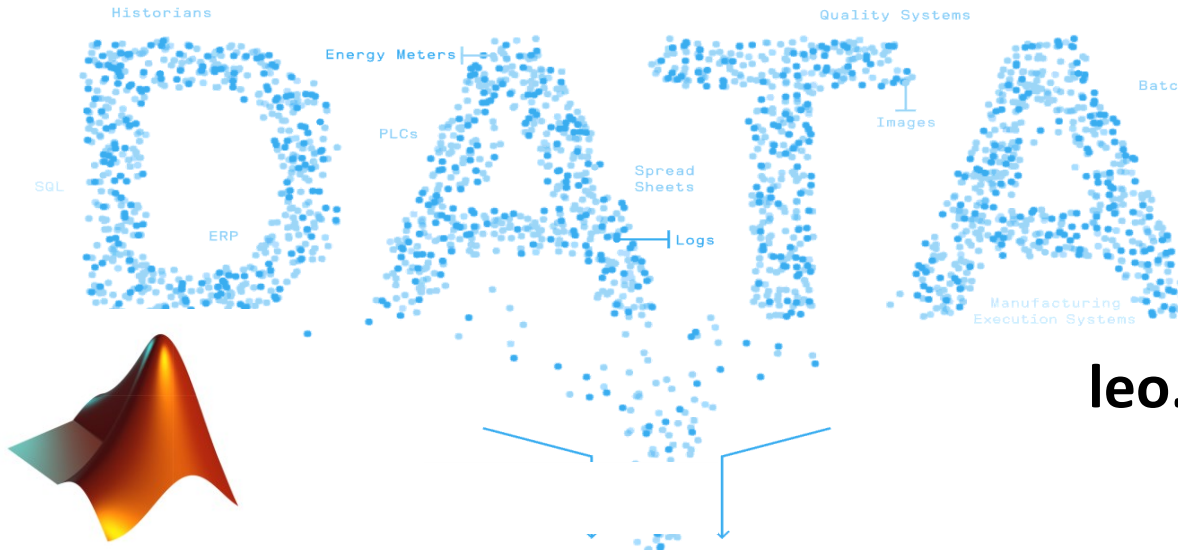


# Introduction to Artificial Intelligence

## - 00 Course Information



**Dr Leo Chen**

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**21/Oct/2020**

# Module Lecturer

- **Leo Chen** ( BSc, MSc, PhD, CEng, FIMechE, FHEA, SMIEEE, MIET)

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- Email: [leo.chen@newcastle.ac.uk](mailto:leo.chen@newcastle.ac.uk)
- <https://www.ncl.ac.uk/engineering/staff/profile/leochen.html#background>

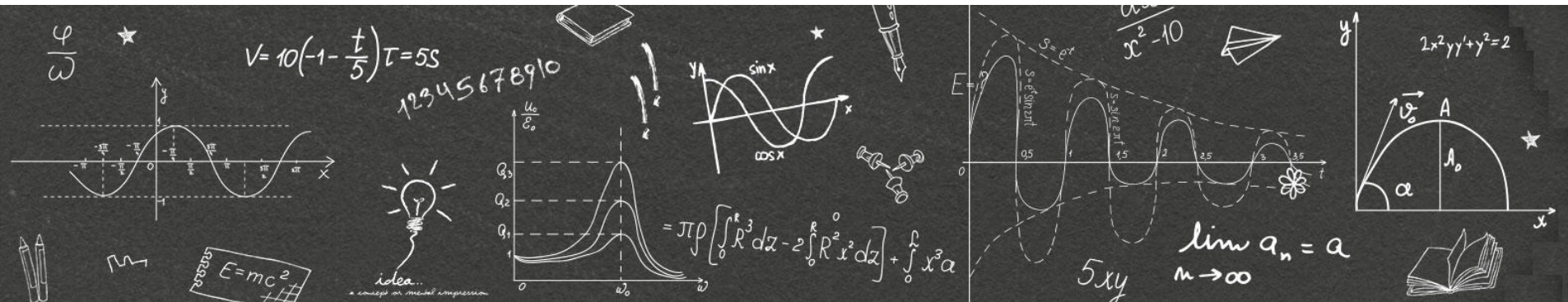
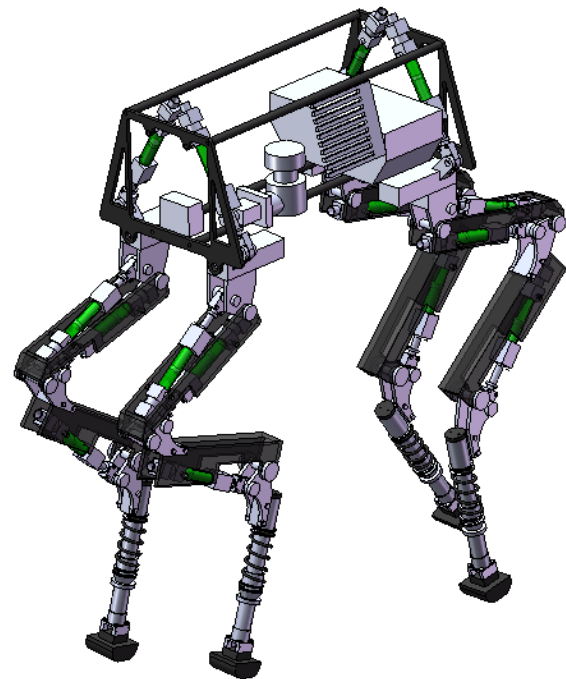


## Research Interests

- Artificial Intelligence
- Industry 4.0 and Digital Manufacturing
- Robotics and Autonomous Systems
- Data Analytics

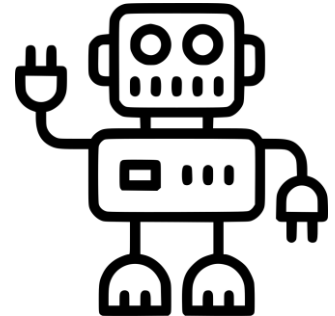
# Contents

- General Information
- Timetable
- Module Contents
- Text Book



# Module Contents

- 1. Introduction**
  - 2. Global Optimisation and Evolutionary Search**
  - 3. Artificial Neural Networks and Learning Systems**
  - 4. Fuzzy Logic and Fuzzy Systems**
  - 5. Some other AI Approaches**
  - 6. AI-driven Design Automation**
  - 7. AI in Applications**
  - 8. Laboratory Handbook**
- FAQ**
- Reference**
- Appendix**



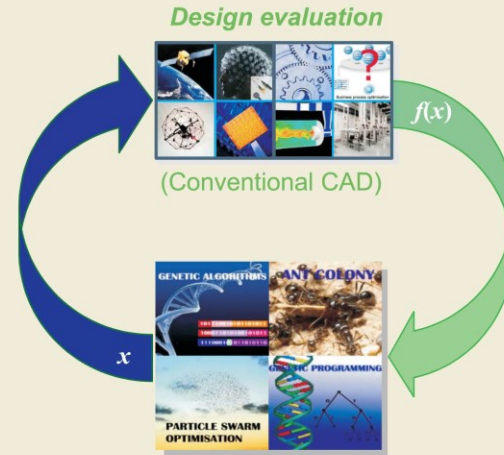
# Text Book

ISBN 9781498760669  
Published July 23, 2018 by CRC Press  
504 Pages 13 Color & 297 B/W Illustrations

For more information visit:  
[www.crcpress.com/9781498760669](http://www.crcpress.com/9781498760669)

## Computational Intelligence Assisted Design In Industrial Revolution 4.0

Yi Chen and Yun Li



*Design evolution*

**CRC** CRC Press  
Taylor & Francis Group

A SCIENCE PUBLISHERS BOOK



# Source Codes of Text Book

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- Yi Chen, Yun Li, (2018), Computational Intelligence Assisted Design (In the Era of Industry 4.0), CRC Press (ISBN 978-1-4987-6066-9)  
<https://www.taylorfrancis.com/books/9781498760676>

## 1) IEEE Code Ocean

- <https://codeocean.com/2018/09/11/computational-intelligence-assisted-design-lpar-ciad-rpar-in-the-era-of-industry-4-0-book-matlab-codes-colon-test-functions/code>

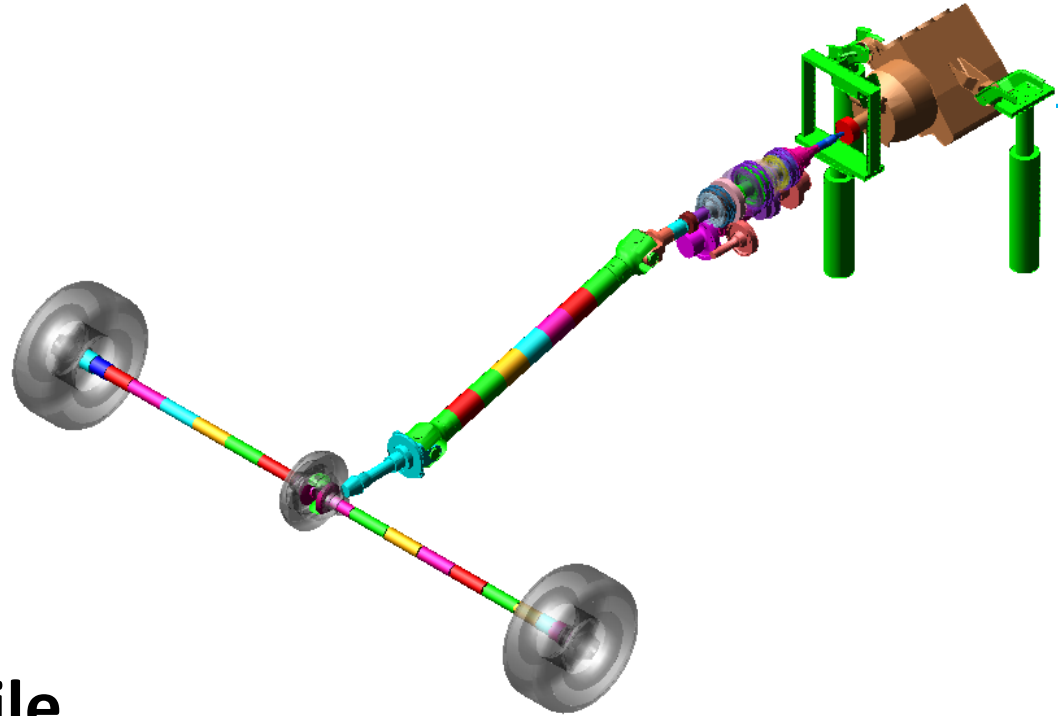
## 2) Mathworks File Exchange

- <https://ww2.mathworks.cn/matlabcentral/fileexchange/68483-ciad-book-test-functions>

# FAQ

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1. Useful Links
2. Assessment
3. Templates
4. Topic Selection
5. Submission
6. How to Access This File
7. MATLAB Learning Resources
8. Acronyms





# FAQ

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**9. Reading List**

**10. AI Documentaries**

**11. Case Studies**

**12. HPC Resource**

**13. AI tools**

**14. AI Strategies**

**15. DeepLearning Framework**

**16. Events**





## 17. Datasets

# FAQ 1-Useful Links

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## [1] Ethics guidelines for trustworthy AI

- <https://ec.europa.eu/digital-single-market/en/news/ethics-guidelines-trustworthy-ai>

## [2] Related Journals

- IEEE Transactions on Evolutionary Computation
- IEEE Transactions on Emerging Topics in Computational Intelligence
- IEEE Transactions on Neural Networks and Learning Systems
- Applied Soft Computing



# FAQ 2-Assessment

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## (1) Report 40%

- 20% C1- **Literature Survey:** Ability to consult literature, summarise information and comprehensively use knowledge
- 20% C2- **Technical Content & Quality of Analysis:** The design plan is correct, the technical route is reasonable, and the experimental design, calculation, analysis and processing are scientific
- 20% C3- **Presentation& Figures:** Technical terms are accurate, symbols are unified, diagrams are complete, clean and correct, and citations are standardised
- 20% C4- **Writing:** Words are fluent, with or without perspective extraction, comprehensive generalisation ability
- 20% C5- **Organisation & Structure:** The overall effect, whether the workload is full, whether the paper length meets the requirements

# FAQ 2-Assessment

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## (2) Presentation 60%: Understanding & Achievement

- 20% **Structure**, is the presentation well structured ?
- 20% **Delivery**, in a professional manner, Timing < 15mins
- 20% **Teamwork**, support each other and project management
- 20% **Problem solving**, how did the team workout the problem
- 20% **Individual performance**

*NB. The assignment project can be undertaken **in pairs**, but the **report** needs to be written **individually** in English, about 15 pages in total (including references and figures).*

## FAQ 2- Submission File List

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1. A technical report (**Compulsory**);
2. A presentation in a video (**Compulsory**);
3. The PowerPoint file go with the video in 2 (**Compulsory**);
4. Other supporting files (e.g. Plagiarism Checking Report, MATLAB/Python Codes, Models, Data, etc.) (**Optional**) .

# Notes:

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- Your video may be generated from a Powerpoint presentation with audio narration.
- It is recommended that you read the guides on how to do a narrated Powerpoint and how to generate a video from it before you start:

**1) Record a slide show with narration** [https://support.office.com/en-us/article/record-a-slide-show-with-narration-and-slide-timings-0b9502c6-5f6c-40ae-b1e7-e47d8741161c#officeversion=office\\_365](https://support.office.com/en-us/article/record-a-slide-show-with-narration-and-slide-timings-0b9502c6-5f6c-40ae-b1e7-e47d8741161c#officeversion=office_365)

**2) Turn your presentation into a video** <https://support.office.com/en-gb/article/turn-your-presentation-into-a-video-c140551f-cb37-4818-b5d4-3e30815c3e83>

# FAQ 3-Templates

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- **Report template**

Link: <https://pan.baidu.com/s/1tYjjcbCv8fb8cipj5Ppew>

Code: a4ne

Also available via:

<https://github.com/LeoYiChen/i4AI/blob/master/i4AI%20template-technical%20report%2020201001.docx>

- **PowerPoint template**

Choose your own PowerPoint template in **16:9** aspect ratio.



## FAQ 4-Topic Selection

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1. In the **scope** of the module, select an area interested you most;
2. In the selected **area**, choose an AI approach to apply it in a case in your research;
3. To finalise a **topic**, which should discuss how to utilise the AI approach or algorithm to design, analyse, optimise and solve your case;
4. Avoid Plagiarism (e.g. checking via Turnitin, <25%)

# Examples:

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- **Spatio-Temporal Evolutionary Analysis of the Township Enterprises of Beijing Suburbs using Computational Intelligence Assisted Design Framework**

<https://www.nature.com/articles/s41599-018-0081-0>

- **Pareto-Optimality Solution Recommendation Using Multi-objective Artificial Wolf-pack Algorithm**

<https://ieeexplore.ieee.org/document/7916207/authors#authors>

- **Cross-Scale Analysis of Nickel Superalloy Fatigue using Markov State Model-Molecular Dynamics Method**
- **How Can Artificial Intelligence Help with Space Missions - A Case Study: Computational Intelligence Assisted Design of Space Tether for Payload Orbital Transfer under Uncertainties**

## FAQ 5- Submission

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(1) Deadline: Week 14, Friday, 11/Dec/2020 @17:00

(2) Submit All in a Zip file to: [leo.chen@newcastle.ac.uk](mailto:leo.chen@newcastle.ac.uk)

if > 50M, submit via  
online storage.



## FAQ 6-How to Access This File

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Link: <https://pan.baidu.com/s/1uz7sZx5DxL4vuQKu3BVZcA>

Code: 3hof

# FAQ 7-MATLAB Learning Resources

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<http://www.mathworks.co.uk/academia/classroom-resources>

# FAQ 8 - Acronym

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- **MPP** **MATLAB Parallel Programming**
- **MPI** **Message Passing Interface**
- **FMI** Functional Mockup Interface
- **PP** Parallel Programming
- **CIAD** Computational Intelligence Aided Design
- **CI** Computational Intelligence
- **AI** Artificial Intelligence
- **i4** Industry 4.0
- **STEM** Science, Technology, Engineering and Mathematics

# FAQ 8 - Machine Learning Glossary

EN:

<https://developers.google.cn/machine-learning/glossary>

[Home](#) > [Products](#) > [Machine Learning](#) > [Glossary](#)



## Machine Learning Glossary

This glossary defines general machine learning terms, plus terms specific to TensorFlow.

★ **Note:** Unfortunately, as of April 2019 we no longer update non-English versions of Machine Learning Crash Course. Please see the English version (the version you are currently reading) for the most up-to-date content.

### Did You Know?

You can **filter the glossary** by choosing a topic from the Glossary dropdown in the top navigation bar.



## 9.1 Reading List – Evolutionary Computation

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- [1] Goldberg, D.E. 1989. Genetic Algorithms in Search, Optimization and Machine Learning. Addison-Wesley Publishing Company, Boston, MA, USA
- [2] Holland, J.J. 1992. Genetic algorithm. Scientific American Magazine, pp. 44–5
- [3] Michalewicz, Z. 1996. Genetic Algorithm + Data Structures = Evolution Programs (3rd ed.). Springer-Verlag, New York, USA
- [4] Mitsuo Gen, Runwei Cheng, Genetic Algorithms and Engineering Optimization, Wiley Series in Engineering Design and Automation, 2000, John Wiley & Sons

## 9.2 Reading List – Artificial Neural Network

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- [1] 邱锡鹏,神经网络与深度学习(Neural Networks and Deep Learning),  
<https://nndl.github.io/>
- [2] Michael Nielsen, Neural Networks and Deep Learning,  
<http://neuralnetworksanddeeplearning.com/>
- [3] Machine Learning with MATLAB (PDF version),  
<https://www.mathworks.com/content/dam/mathworks/ebook/gated/machine-Learning-ebook.pdf>
- [4] Statistical learning methods, 统计学习方法(第2版)[李航] [笔记, 代码, notebook, 参考文献, Errata, lihang], <https://github.com/SmirkCao/Lihang>
- [5] Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong, Mathematics for Machine Learning, <https://mml-book.github.io/>
- [6] 周志华, 机器学习, 清华大学出版社

## 9.2 Reading List – Artificial Neural Network

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- [7] **动手学深度学习**, 2020 年 05月08日 , <https://zh.d2l.ai>
- [8] **Deep Reinforcement Learning**, CS 285 at UC Berkeley,  
<http://rail.eecs.berkeley.edu/deeprlcourse/>
- [9] 吴恩达, deeplearning.ai
- [10] 李宏毅, 一天搞懂深度学习
- [11] **深度学习框架的来龙去脉**  
<https://zhuanlan.zhihu.com/p/59086302>
- [12] PyTorch vs Tensorflow for Your Python Deep Learning Project  
<https://realpython.com/pytorch-vs-tensorflow/>
- [13] Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. MIT press.  
<http://www.deeplearningbook.org/>

# 神经网络与深度学习 (邱锡鹏，复旦大学)

- 第1章是绪论，介绍人工智能、机器学习、深度学习的概要，使读者对相关知识进行全面的了解。
- 第2、3章介绍了机器学习的基础知识。
- 第4、5、6章分别讲述三种主要的神经网络模型：前馈神经网络、卷积神经网络和循环神经网络。在第6章中略提了下图网络的内容。
- 第7章介绍神经网络的优化与正则化方法。
- 第8章介绍神经网络中的注意力机制和外部记忆。
- 第9章简要介绍了一些无监督学习方法。
- 第10章中介绍一些和模型独立的机器学习方法：集成学习、协同学习、多任务学习、迁移学习、终生学习、小样本学习、元学习等。这些都是目前深度学习的难点和热点问题。
- 第11章介绍了概率图模型的基本概念，为后面的章节进行铺垫。
- 第12章介绍两种早期的深度学习模型：玻尔兹曼机和深度信念网络。
- 第13章介绍最近两年发展十分迅速的深度生成模型：变分自编码器和对抗生成网络。
- 第14章介绍了深度强化学习的知识。
- 第15章介绍了应用十分广泛的序列生成模型。

## 9.3 Reading List – Fuzzy Logic

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[1] Zadeh, L.A. 2008. Is there a need for fuzzy logic? Information Sciences 178: 2751–2779.

[2] Zadeh, L.A. 1965. Fuzzy Sets. Information and Control 8: 338–353,  
<https://www.sciencedirect.com/science/article/pii/S001999586590241X>

## 9.4 Others

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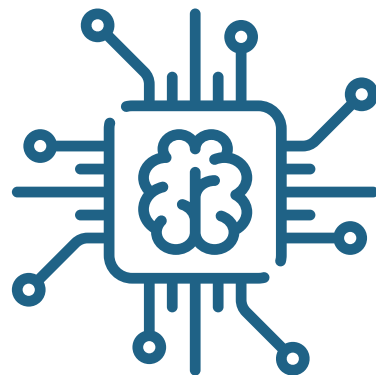
[1] [清华大学2020年春季的课程-《高级机器学习》](#)

[2] [Data Science Infographic](#)

<https://github.com/dataprofessor/infographic>

[3] AI-Expert-Roadmap

<https://github.com/AMAI-GmbH/AI-Expert-Roadmap>



## 10. AI Documentaries

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- \00-Course info\FAQ-10 Documentaries



# 11. Case Studies

- 2020年度最佳的23个的机器学习项目

- Google-Recreating historical Streets

<https://ai.googleblog.com/2020/10/recreating-historical-streetscapes.html>

Ra工具集：

<https://re.city/#14.25/40.74094/-73.98798>

- 微软模拟飞行

- Tesla from Autopilot to Full Self-Driving(FSD)

- 飞桨PaddleOCR超轻量中英文识别

<https://github.com/PaddlePaddle/PaddleOCR>

- PP-YOLO 对铁轨进行缺陷检测

<https://github.com/paddlepaddle/paddledetection>



# 11. Case Studies

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- **Keytap** - 通过监听你敲击键盘的声音，就能还原出你输入的内容

<https://github.com/ggerganov/kbd-audio>

<https://ggerganov.github.io/jekyll/update/2018/11/30/keytap-description-and-thoughts.html>

# 12. HPC Resource

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- 12.1 DGUT HPC