
WEEK 1 TERM 2:

MSIN0097

UCL
SCHOOL OF
MANAGEMENT

PREDICTIVE ANALYTICS Assignment Project Exam Help

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A P MOORE

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A bit about me

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MY BACKGROUND

CURRENT | PREVIOUS

UCL
SCHOOL OF
MANAGEMENT



Alastair Moore

Head of Analytics and Machine Learning

Senior Teaching Fellow

Predictive Analytics

MSc Business Analytics

UCL School of Management

Mishcon de Reya

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MBA Programme,

Innovation and Entrepreneurship in Europe

Emerging Business Technologies

BiMBA Peking University

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Co-Founder

Satalia.com



Co-Founder

WeArePopUp.com



Partner

AMAAMS LLP



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Satalia

[Products](#)
[Services](#)
[Clients](#)
[Careers](#)
[About](#)

Enterprise AI
We use artificial intelligence to solve exponentially hard efficiency problems.

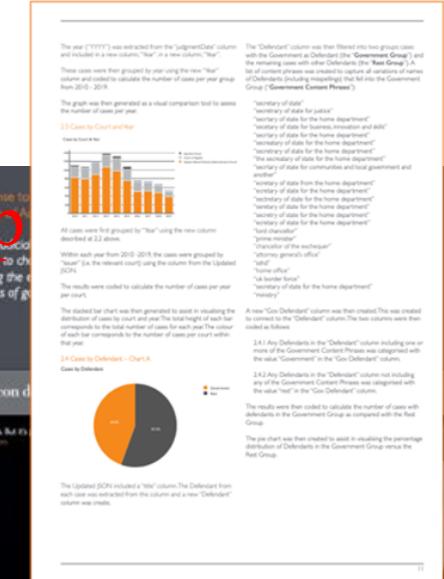
We're 120 people, distributed across Europe. For the last 10 years, we've been building machine learning systems for some of the world's most interesting companies, including Tesla and PwC. Most companies that touch data are calling themselves an AI company — they're not. We're one of the few companies combining machine learning with optimisation to build decision making systems that radically improve operational efficiency.



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OPEN BANKING

WORKING WITH NESTA ON CHALLENGE LEAD APPROACHES



OP

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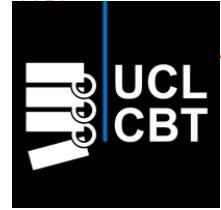
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**What will the bank account look
like in 2030?**

DLT SYSTEMS

USE OF DISTRIBUTED LEDGERS IN REAL ESTATE

Land Registry

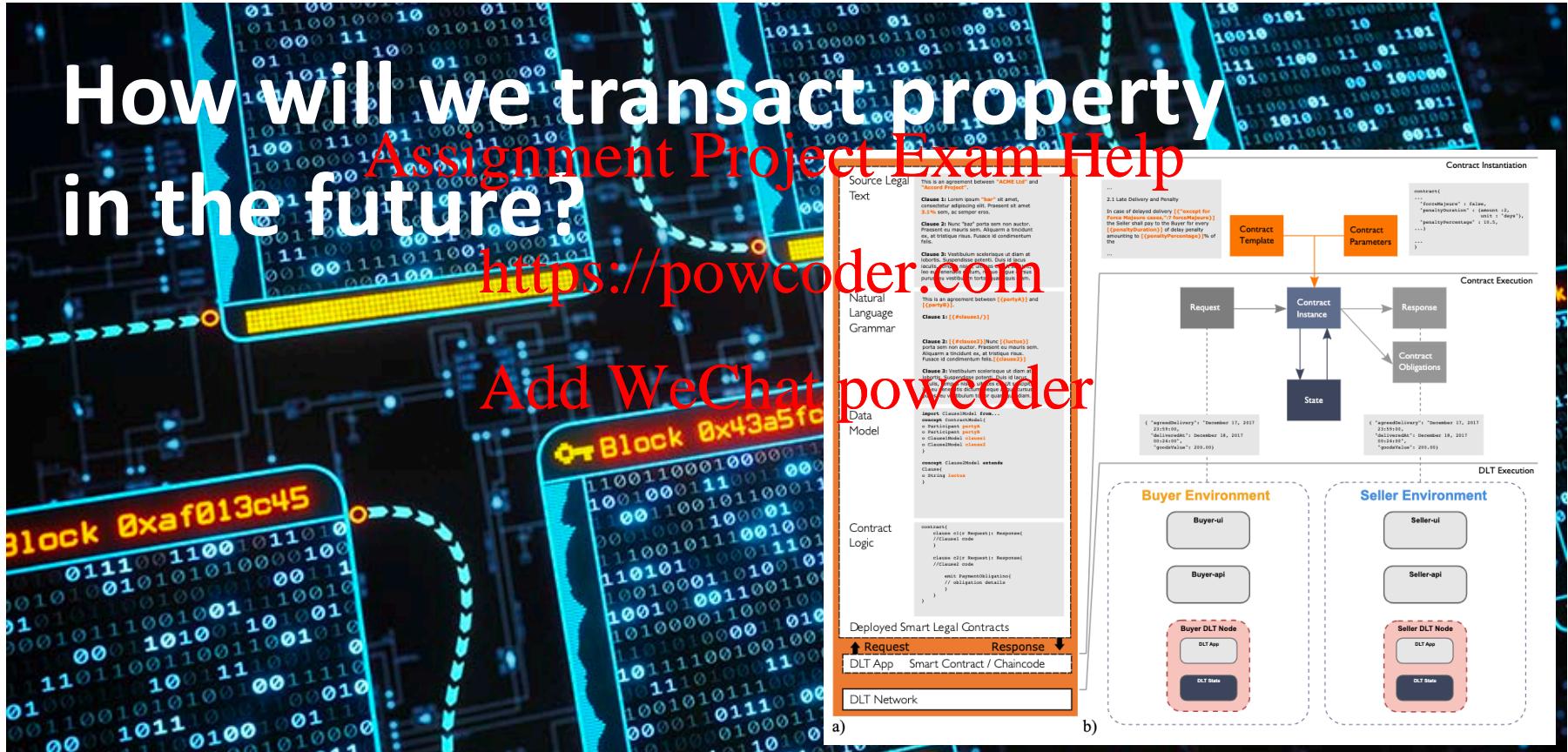


How will we transact property in the future?

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RESEARCH INTERESTS

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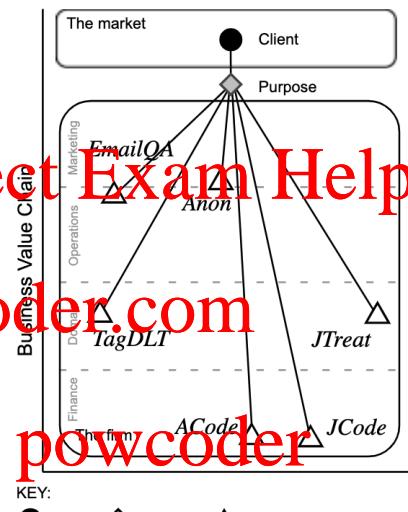
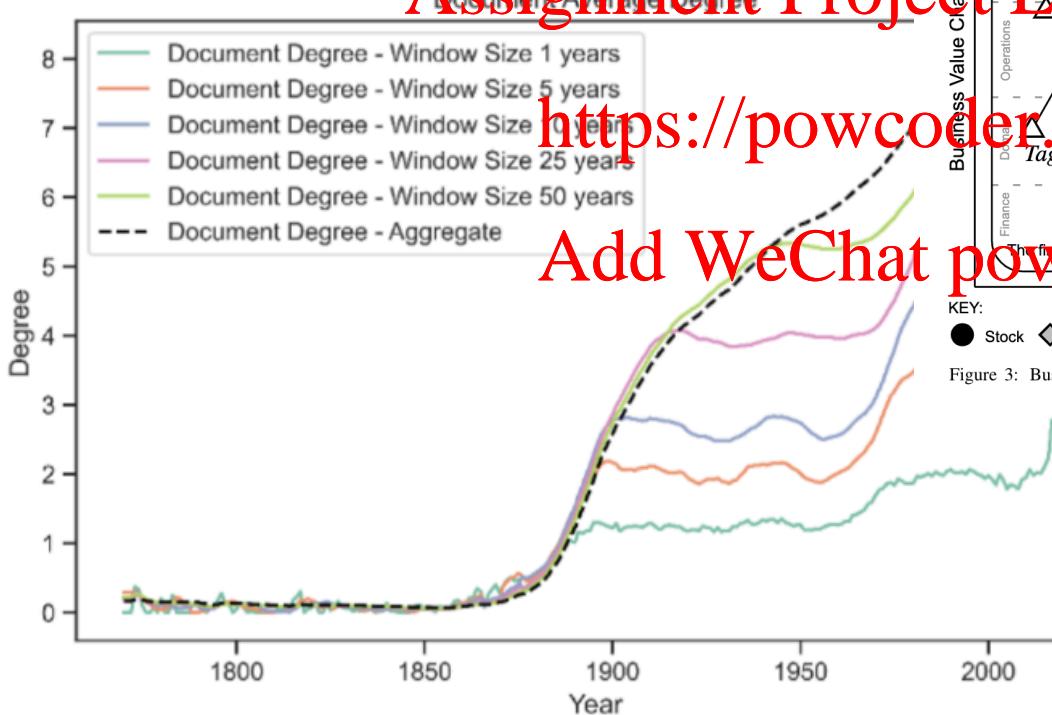


Figure 3: Business value chains. Distribution of selected nodes.

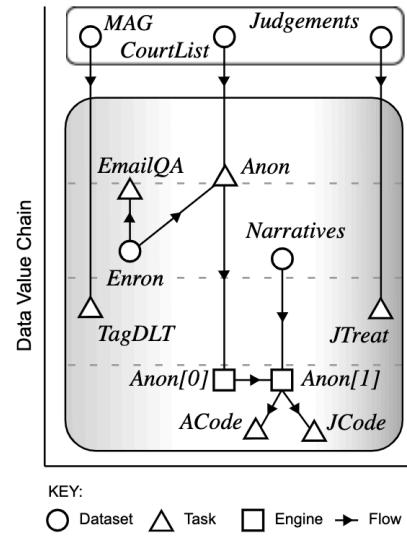


Figure 4: Data value chains. Showing the dependencies.

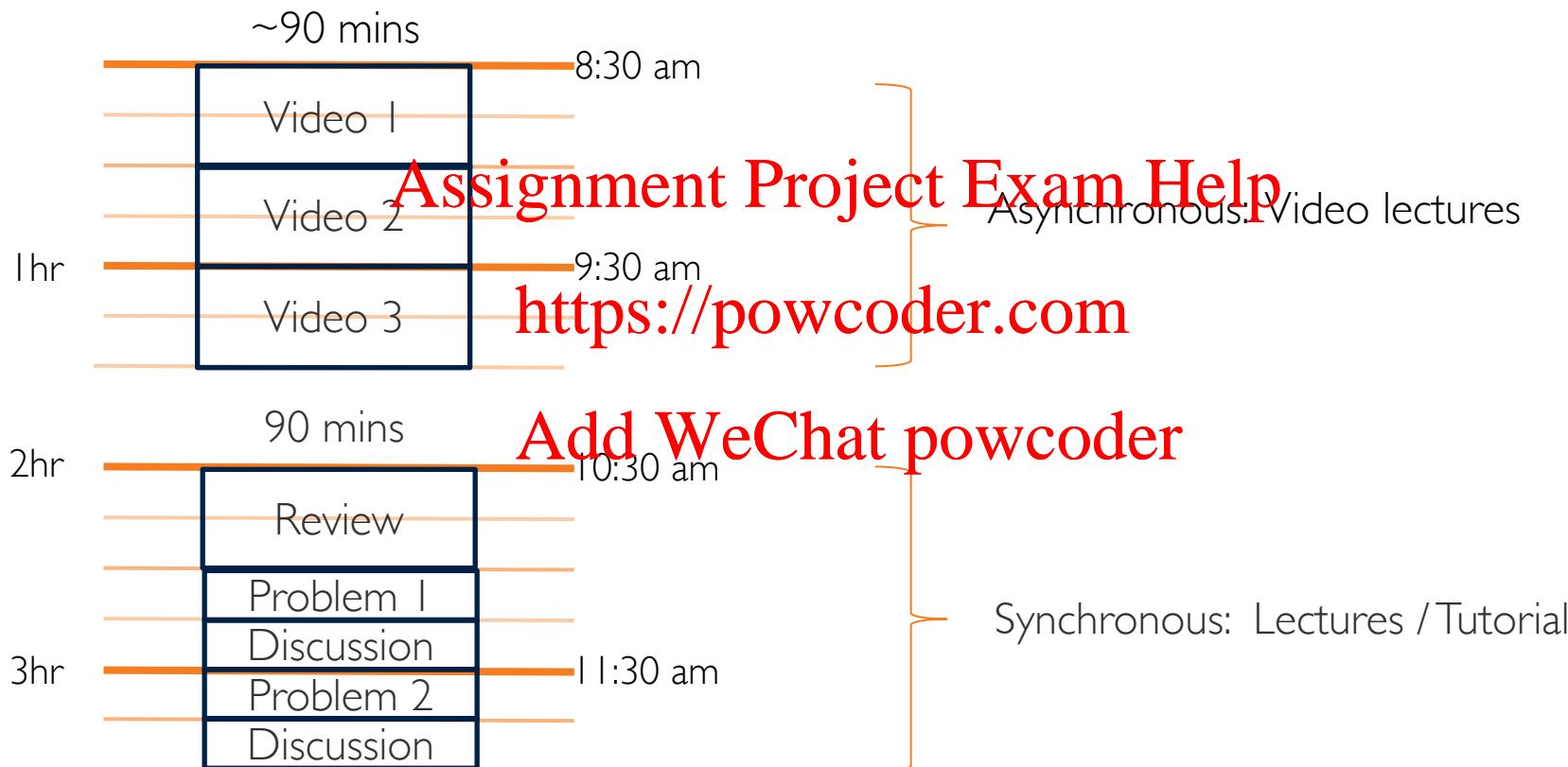
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Course overview

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TODAY

LECTURE / WORKSHOP SCHEDULE



HANDS ON MACHINE LEARNING

GIT

The screenshot shows the GitHub repository page for 'ageron/handson-ml'. The repository title 'Assignment Project Exam Help' is prominently displayed in red. Below it, the repository details show 116 issues, 16 pull requests, 1.1k stars, 21.9k forks, and 11.8k code commits. The repository description explains it's a series of Jupyter notebooks for machine learning and deep learning using Scikit-Learn and TensorFlow. The main content area displays a timeline of commits from Week 1 to Week 8, with each commit being a Jupyter notebook file. An orange arrow points downwards from the repository title towards the commit list.

ageron / handson-ml

Why GitHub? Team Enterprise Explore Marketplace Pricing

Search Sign in Sign up

Code Issues Pull requests Actions Projects Security Insights

Watch 1.1k Star 21.9k Fork 11.8k

ageron / handson-ml

Assignment Project Exam Help

A series of Jupyter notebooks that walk you through the fundamentals of Machine Learning and Deep Learning in python using Scikit-Learn and TensorFlow.

tensorflow scikit-learn
machine-learning python
deep-learning neural-network ml
distributed jupyter-notebook

Readme Apache-2.0 License

Releases No releases published

Packages No packages published

Contributors 38

+ 27 contributors

Week 1

Week 2

Week 4

Week 5

Week 3

Week 6

Week 7

Week 8

0322dce on 15 Apr 460 commits

datasets Update README.md 3 years ago

docker Fixed docker build issue 16 months ago

images Add clustering, density estimation and anomaly detection to chapter 6 3 years ago

.gitignore Add *.old, *.dot and lifesat.csv (generated) to .gitignore 3 years ago

01_the_machine_learning_landscape.ipynb Add missing import, fixes #510 14 months ago

02_end_to_end_machine_learning.ipynb Import 3rd party use os module, fix existing imports 15 months ago

03_classification.ipynb import matplotlib as mpl and use mpl.rc() 2 years ago

04_training_linear_models.ipynb Crop long outputs to make it easier to visualize the notebooks on git... 2 years ago

05_support_vector_machines.ipynb Crop long outputs to make it easier to visualize the notebooks on git... 2 years ago

06_decision_trees.ipynb import matplotlib as mpl and use mpl.rc() 2 years ago

07_ensemble_learning_and_random_forests.ipynb bst_n_estimators should be argmin(errors) + 1, fixes #445 2 years ago

08_dimensionality_reduction.ipynb Crop long outputs to make it easier to visualize the notebooks on git... 2 years ago

09_up_and_running_with_tensorflow.ipynb Use tensorflow_graph_in_jupyter.py in notebooks, fixes #223 3 years ago

10_introduction_to_artificial_neural_networks.ipynb Crop long outputs to make it easier to visualize the notebooks on git... 2 years ago

11_deep_learning.ipynb Crop long outputs to make it easier to visualize the notebooks on git... 2 years ago

12_distributed_tensorflow.ipynb Add a quick intro to the Data API in notebook 12 3 years ago

13_convolutional_neural_networks.ipynb Use fc1_drop instead of fc1, fixes #304 17 months ago

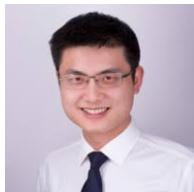
14_recurrent_neural_networks.ipynb Small spelling improvements to the RNN chapter 17 months ago

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Kamil Tylinski
Teaching Assistant
kamil.tylinski.16@ucl.ac.uk

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Jiangbo Shangguan
Teaching Assistant
j.shangguan.17@ucl.ac.uk

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Bartos Kultys
Teaching Assistant
bartosz.kultys.18@ucl.ac.uk



Dr Viviana Culmone
Teaching Assistant
v.culmone@ucl.ac.uk



Editha Nemsic
Teaching Assistant
editha.nemsic.19@ucl.ac.uk



Walter Hernandez
Teaching Assistant
walter.hernandez.18@ucl.ac.uk

- Individual Coursework - 60%

- 2000 words

- Due Date: Friday 26th February 2021

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- Group Coursework - 40%

- 4-5 per group

- Deadline for Group formation: **Friday 29th January 2021 (week 3)**

- 2000 words

- Due Date: Thursday 18th March 2021

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Review

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DEEP LEARNING

STATE OF THE ART

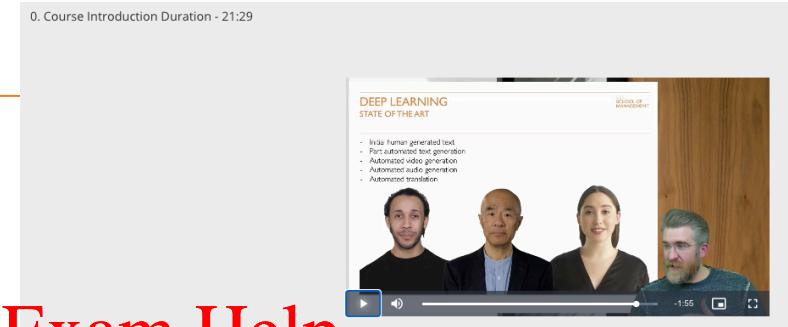
- Initial human generated text
- Part automated text generation
- Automated video generation
- Automated audio generation
- Automated translation



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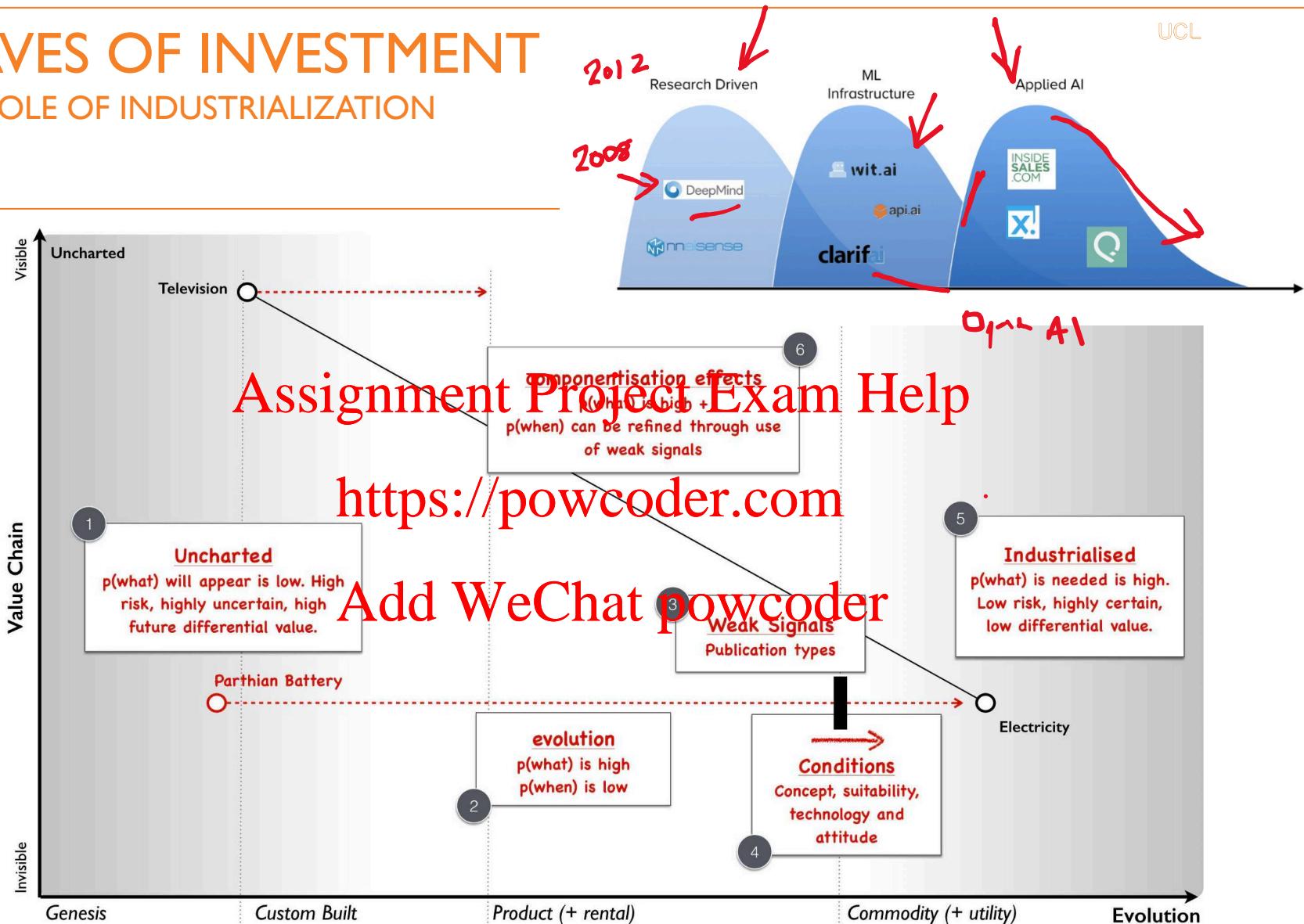
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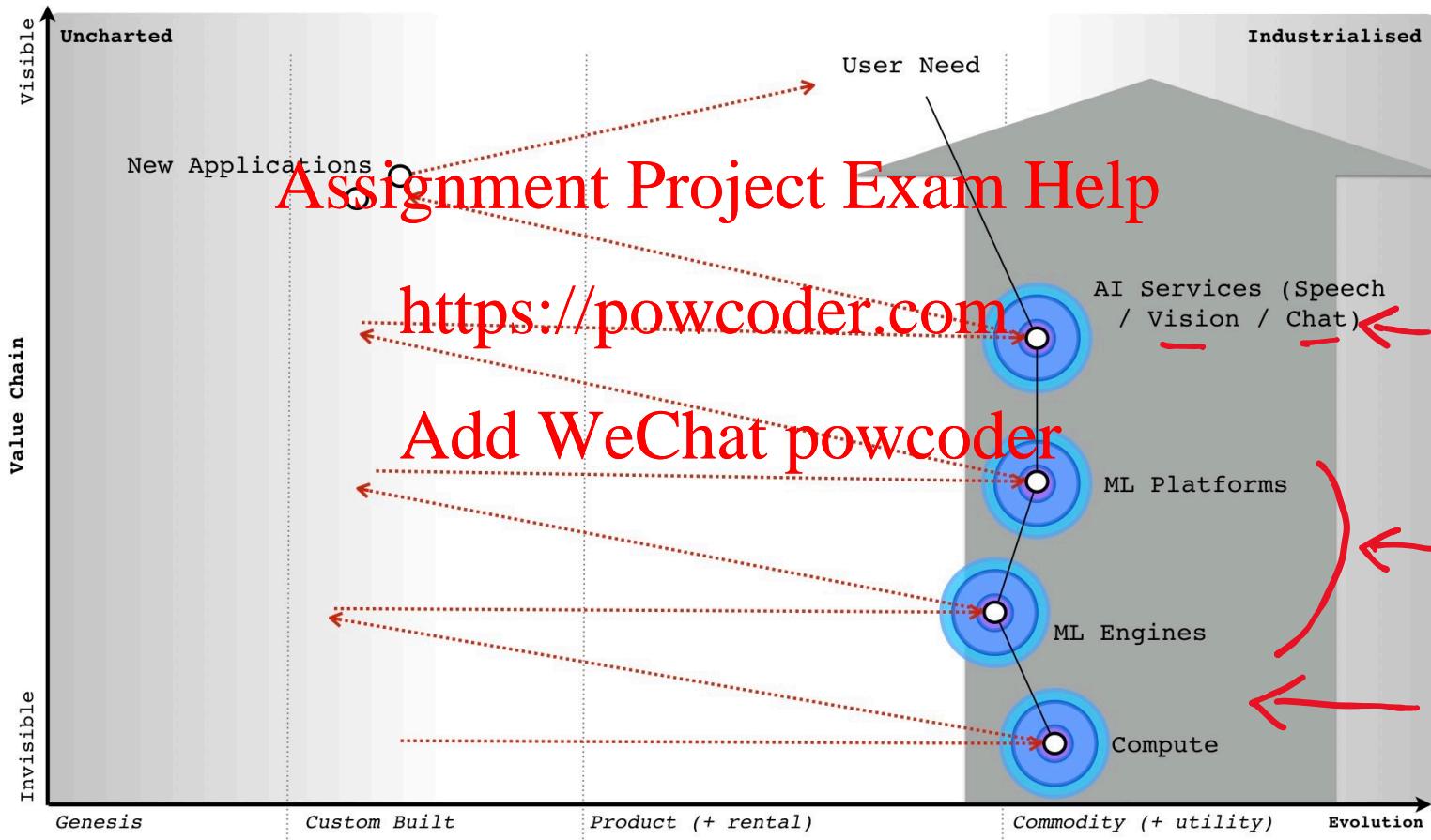
WAVES OF INVESTMENT

THE ROLE OF INDUSTRIALIZATION

UCL



TOWER & MOAT



MACHINE LEARNING JARGON

- | | | |
|---------------------------------|------------------------|-------------------------------|
| — Model | — Parameters | — Failure modes |
| — Interpolating / Extrapolating | — Optimisation | — Confusion matrix |
| — Data Bias | — Training data | — True Positive |
| — Noise / Outliers | — Testing data | — False Negative |
| — Learning algorithm | — Error metric | — Data density |
| — Inference algorithm | — Linear model | — Partition |
| — Supervised learning | — Parametric model | — Hidden parameter |
| — Unsupervised learning | — Model variance | — High dimensional space |
| — Classification | — Model bias | — Low dimensional space |
| — Regression | — Model generalization | — Separable data |
| — Clustering | — Overfitting | — Manifold / Decision surface |
| — Decomposition | — Goodness-of-fit | — Hyper cube / volume / plane |
| | — Hyper-parameters | |
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- 模型
- 内插 / 外推
- 数据偏差
- 噪声 / 离群值
- 学习算法
- 推断算法
- 监督学习
- 无监督学习
- 分类
- 回归
- 聚类
- 分解

- 参数
- 优化
- 训练数据
- 测试数据
- 误差指标
- 线性模型
- ~~参数模型~~
- 模型方差
- 模型偏差
- 模型泛化
- 过拟合
- 拟合优度
- 超参数
- 失败模式
- 混淆矩阵
- 真正例
- 假反例
- 数据密度
- 划分
- 隐藏参数
- 高维空间
- 低维空间
- 可分数据
- 流形/ 决策面
- 超立方体 / 超体积 / 超平面

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Data + model → prediction
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Assume there is enough data to find statistical associations to solve specific tasks

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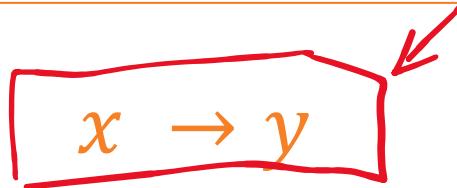
Data + model → prediction

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Define how well the model solves the task and adapt the parameters to maximize performance

LEARNING A FUNCTION



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$$x \rightarrow f(x) \rightarrow y$$

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LEARNING A FUNCTION

$$x \rightarrow y$$

Assignment Project Exam Help

$$x \rightarrow f(x) \rightarrow y$$

<https://powcoder.com>

Measured data

$$x \xrightarrow{\text{Features}} \hat{x} \xrightarrow{\text{Add WeChat powcoder}} f(\hat{x}) = \hat{y} \xrightarrow{\text{Inferred/Predicted/Estimated value}} y$$

True initial value
(world state)

Learned/Fitted function
From n observations

True target value
(world state)

LEARNING A FUNCTION

$$x \rightarrow y$$

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$$x \rightarrow f(x) \rightarrow y$$

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Measured data

$$x \xrightarrow{\text{Features}} \hat{x} \xrightarrow{\text{Add WeChat powcoder}} f(\hat{x}) = \hat{y} \xrightarrow{\text{Inferred/Predicted/Estimated value}} y$$

True initial value
(world state)

Learned/Fitted function
From n observations

True target value
(world state)

input

$$x \rightarrow \boxed{f(x)} \rightarrow y$$

output

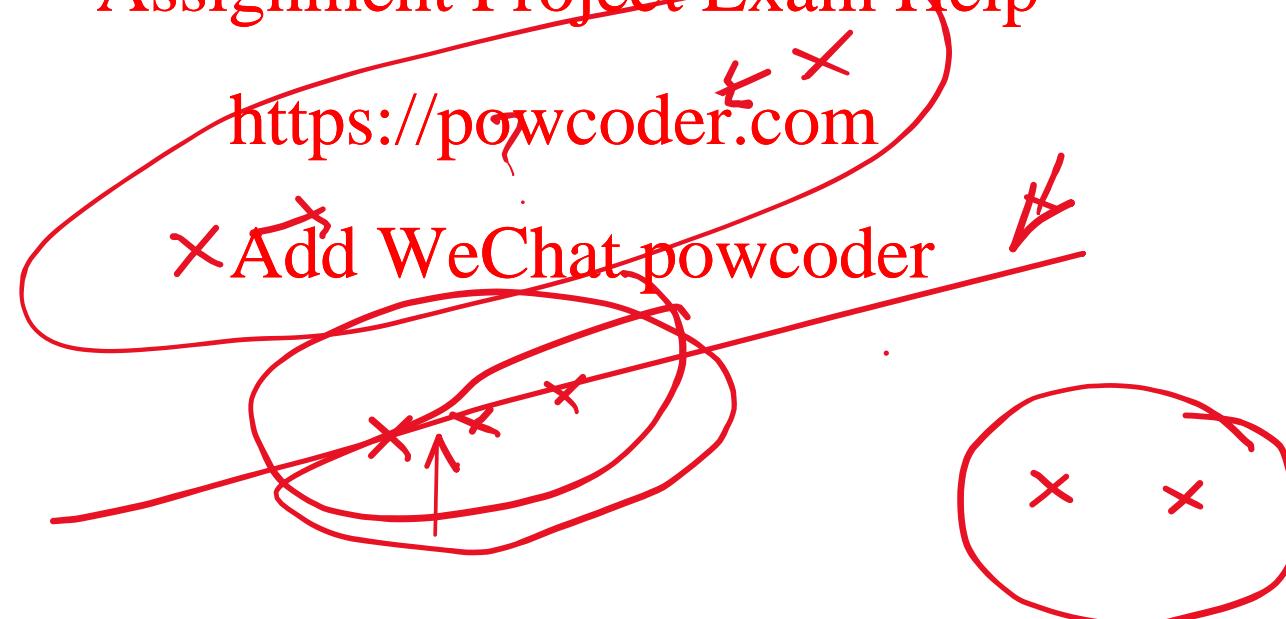
INTERPOLATING / 内插

NÈI CHĀ

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EXTRAPOLATING / 外推

WÀI TUĪ

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NOISE, OUTLIERS / 噪声 , 离群值

ZÀOSHĒNG , LÍ QÚN ZHÍ

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variance



LEARNING ALGORITHM / 学习算法

XUÉXÍ SUÀNFĀ

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笔

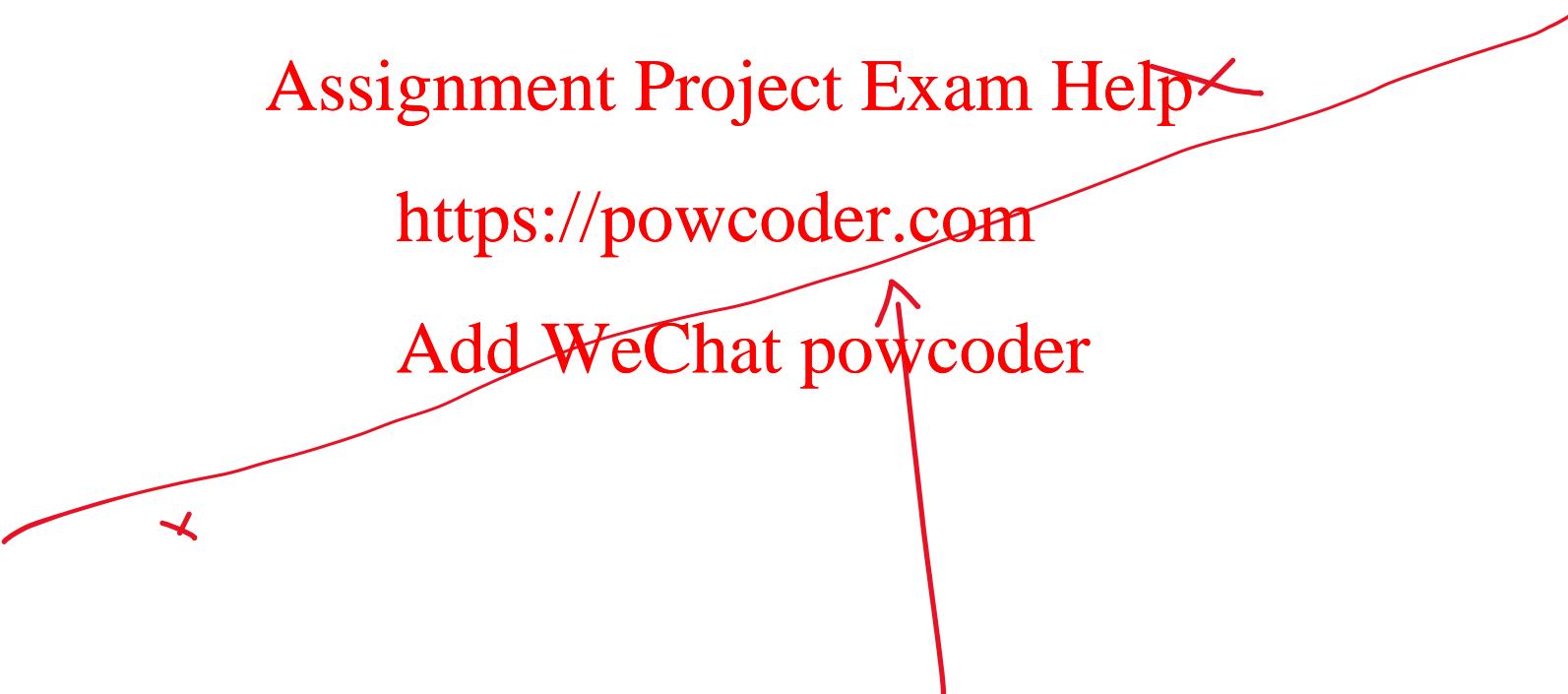
INFERENCE ALGORITHM / 推断算法

TUÍDUÀN SUÀNFĀ

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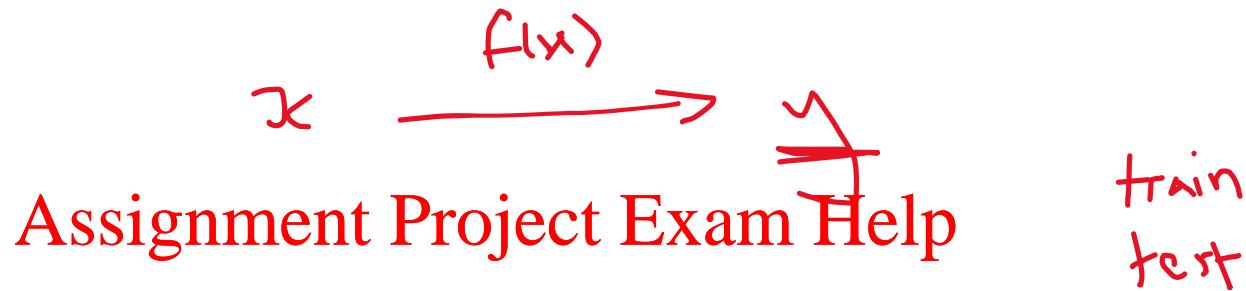
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SUPERVISED LEARNING / 监督学习

JIĀNDŪ XUÉXÍ



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X

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goodness

- similar
- closeness

CLASSIFICATION / 分类

FĒNLÈI

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REGRESSION / 回归分析

HUÍGUĪ FĒNXÌ

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CLUSTERING / 聚类

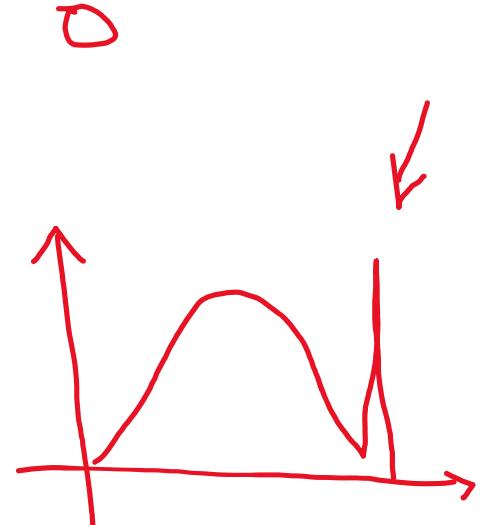
JÙ LÈI

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DECOMPOSITION / 分解

FĒNJIĚ

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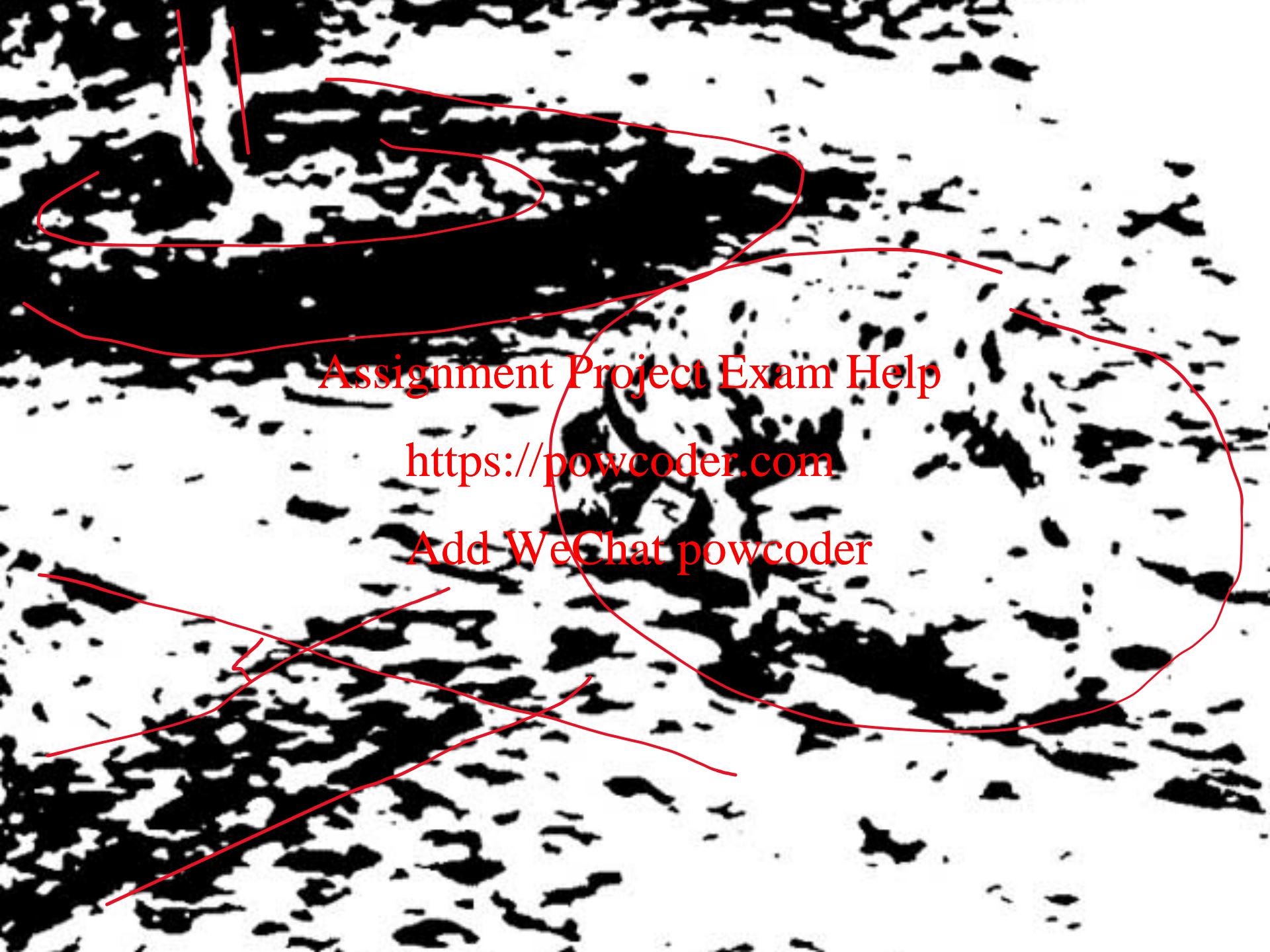
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Perception, Patterns and Gestalt

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The increase in computing power
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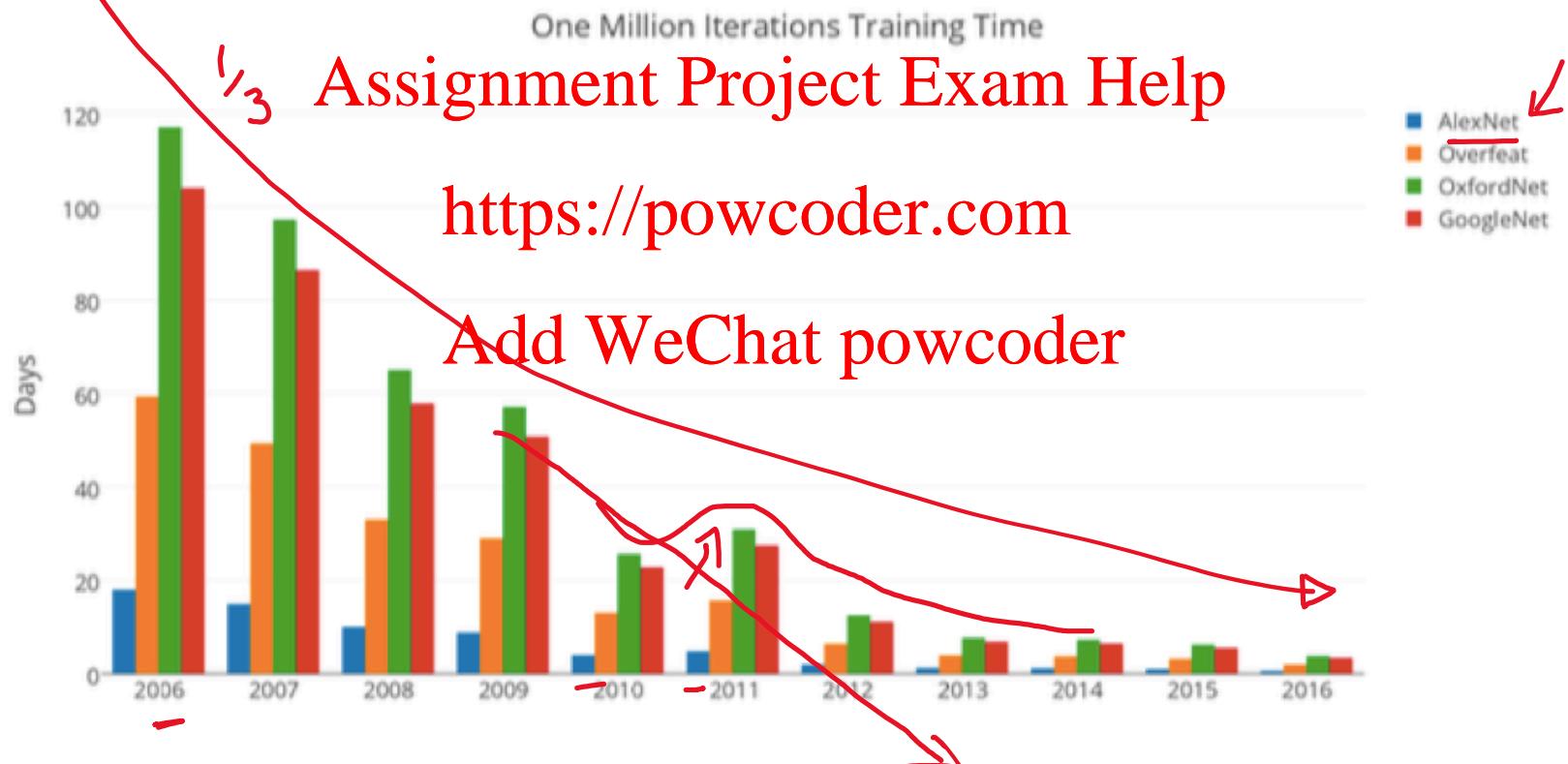
TRAINING TIMES

1970s

250,000

1

imagnet?



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Problem 1

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~15 mins group work

~15 mins discussion

PRACTICAL TOOLS

ML CANVAS

The Machine Learning Canvas (v0.4) Designed for: Designed by: Date: Iteration:

Decisions How are predictions used to make decisions that provide the proposed value to the end-user?	ML task Input, output to predict, type of problem.	Value Propositions What are we trying to do for the end-user(s) of the predictive system? What objectives are we serving?	Data Sources Which raw data sources can we use (internal and external)?	Collecting Data How do we get new data to learn from (inputs and outputs)?
Making Predictions When do we make predictions on new inputs? How long do we have to feature a new input and make a prediction?	Offline Evaluation Methods and metrics to evaluate the system before deployment.	Features How are representations extracted from raw data sources.	Building Models When do we create/update models with new training data? How long do we have to featureize training inputs and create a model?	
Live Evaluation and Monitoring Methods and metrics to evaluate the system after deployment, and to quantify value creation.				

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The Machine Learning Canvas (v0.4)

Designed for:

Designed by:

Date:

Iteration:

Decisions  How are predictions used to make decisions that provide the proposed value to the end-user?	ML task  Input, output to predict, type of problem.	Value Propositions  What are we trying to do for the end-user(s) of the predictive system? What objectives are we serving?	Data Sources  Which raw data sources can we use (internal and external)? 	Collecting Data  How do we get new data to learn from (inputs and outputs)? 	
Making Predictions  When do we make predictions on new inputs? How long do we have to featurize a new input and make a prediction?	Offline Evaluation  Methods and metrics to evaluate the system before deployment.	<p style="color: red; font-size: 2em;">Assignment Project Exam Help https://powcoder.com Add WeChat powcoder</p>			
Live Evaluation and Monitoring  Methods and metrics to evaluate the system after deployment, and to quantify value creation.					

Learn



The Machine Learning Canvas (v0.4)

Designed for:

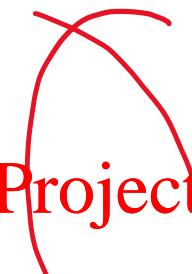
Designed by:

Date:

Iteration:

Prediction

Learn

Decisions How are predictions used to make decisions that provide the proposed value to the end-user?	ML task Input, output to predict, type of problem.	Value Propositions What are we trying to do for the end-user(s) of the predictive system? What objectives are we serving? 	Data Sources Which raw data sources can we use (internal and external)?	Collecting Data How do we get new data to learn from (inputs and outputs)?
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Live Evaluation and Monitoring Methods and metrics to evaluate the system after deployment, and to quantify value creation. 				

The Machine Learning Canvas (v0.4)

Designed for:

Designed by:

Date:

Iteration:

Domain



Decisions  How are predictions used to make decisions that provide the proposed value to the end-user?	ML task  Input, output to predict, type of problem.	Value Propositions  What are we trying to do for the end-user(s) of the predictive system? What objectives are we serving?	Data Sources  Which raw data sources can we use (internal and external)?	Collecting Data  How do we get new data to learn from (inputs and outputs)?
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Live Evaluation and Monitoring  Methods and metrics to evaluate the system after deployment, and to quantify value creation.				Building Models  When do we create/update models with new training data? How long do we have to featurize training inputs and create a model?

The Machine Learning Canvas (v0.4)

Designed for:

Designed by:

Date:

Iteration:

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Live Evaluation and Monitoring  Methods and metrics to evaluate the system after deployment, and to quantify value creation.				

Hands-on Machine Learning

Chapter 2: End-to-End Machine Learning Project

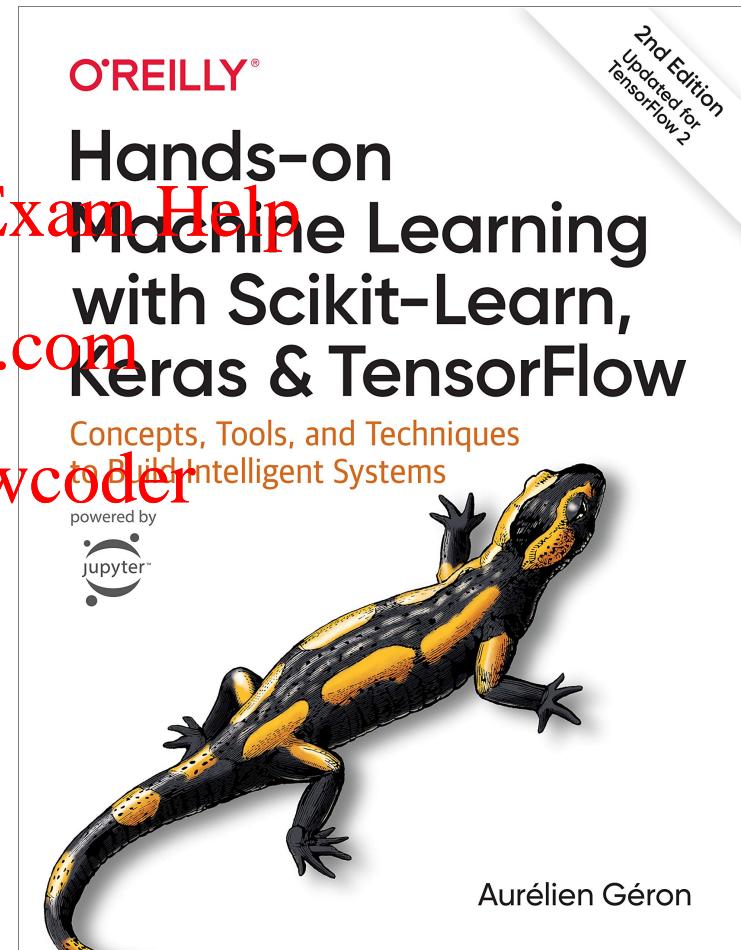
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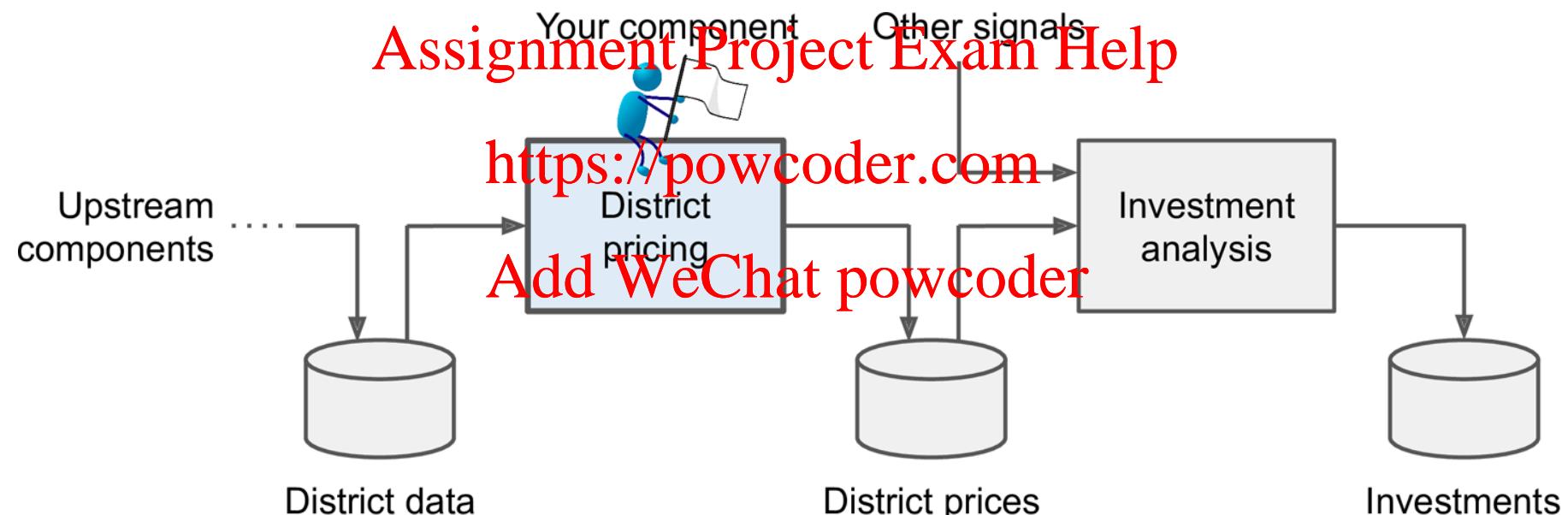
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Try reading the Chapter from start to finish. We will work through the problem in class but please come prepared to discuss the case study.

It is easier to understand the different stages of a ML project if you follow one from start to finish.

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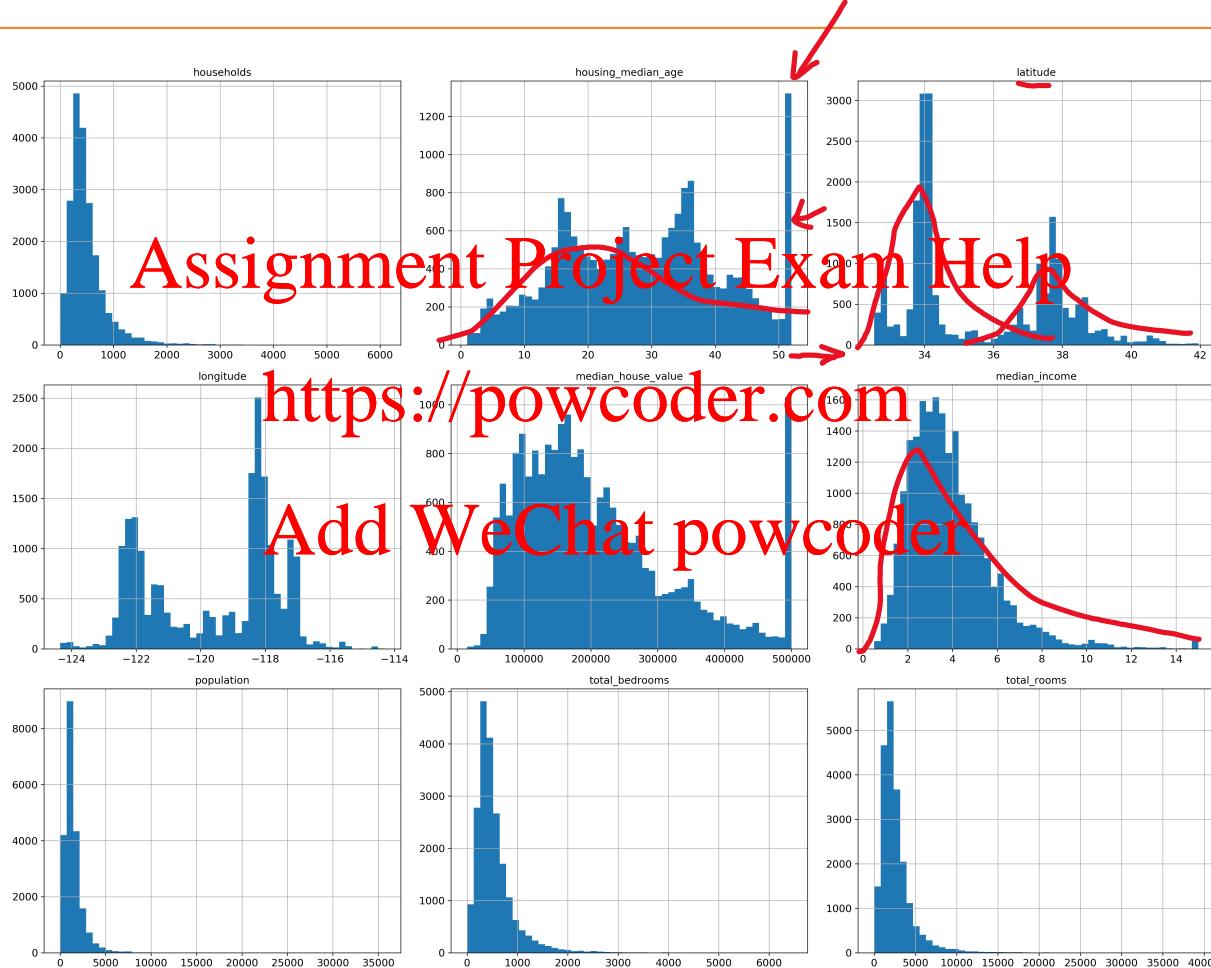


CALIFORNIA HOUSING DATASET

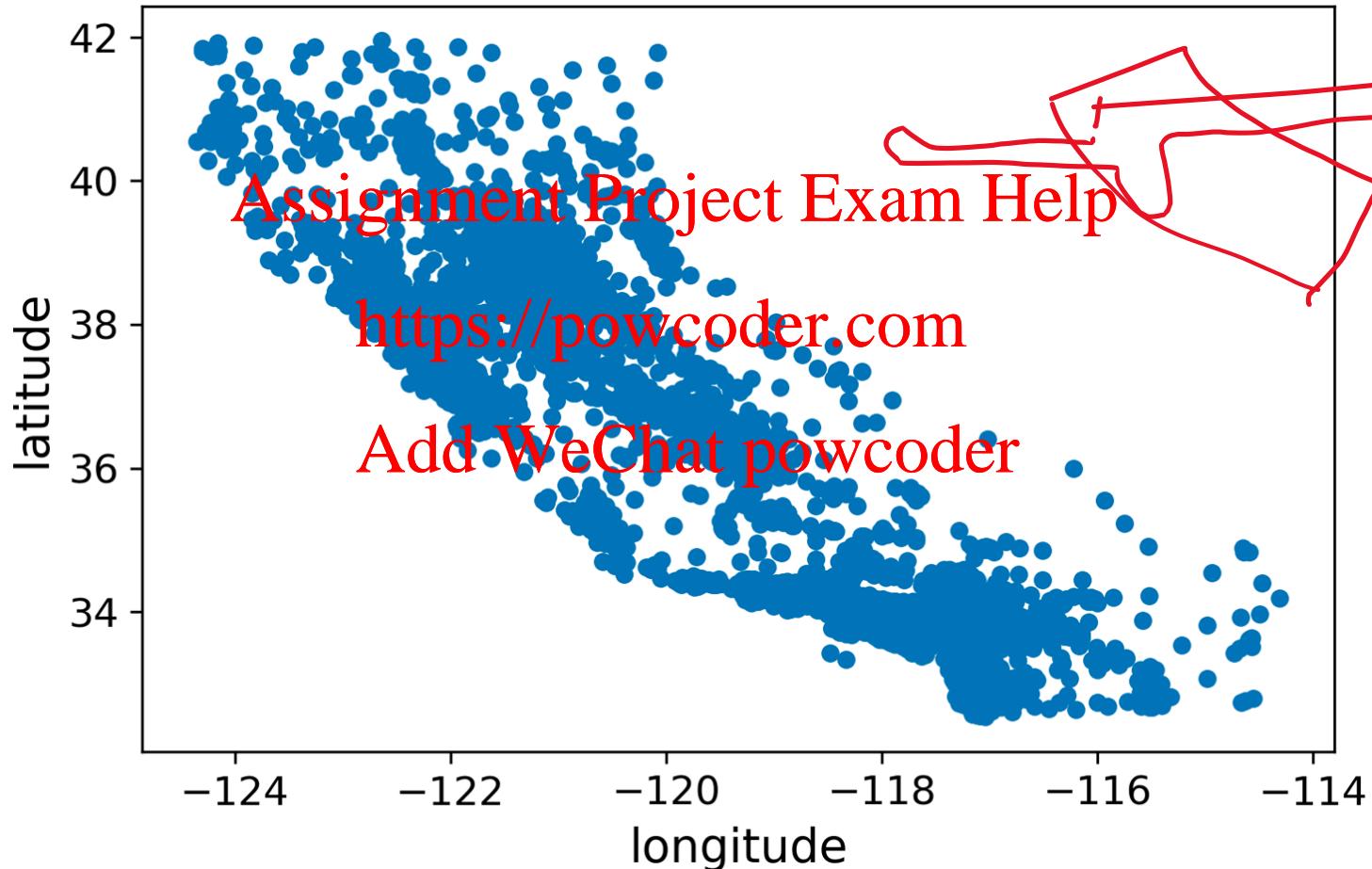
HMLST – CHAPTER 2

	longitude	latitude	housing_median_age	total_rooms
count	20640.000000	20640.000000	20640.000000	20640.000000
mean	-119.569704	35.631861	28.639486	2635.763081
std	2.003532	2.135952	12.585558	2181.615252
min	-124.350000	32.540000	1.000000	2.000000
25%	-121.800000	33.930000	18.000000	1447.750000
50%	-118.490000	34.260000	29.000000	2127.000000
75%	-118.010000	37.710000	37.000000	3148.000000
max	-114.310000	41.950000	52.000000	39320.000000

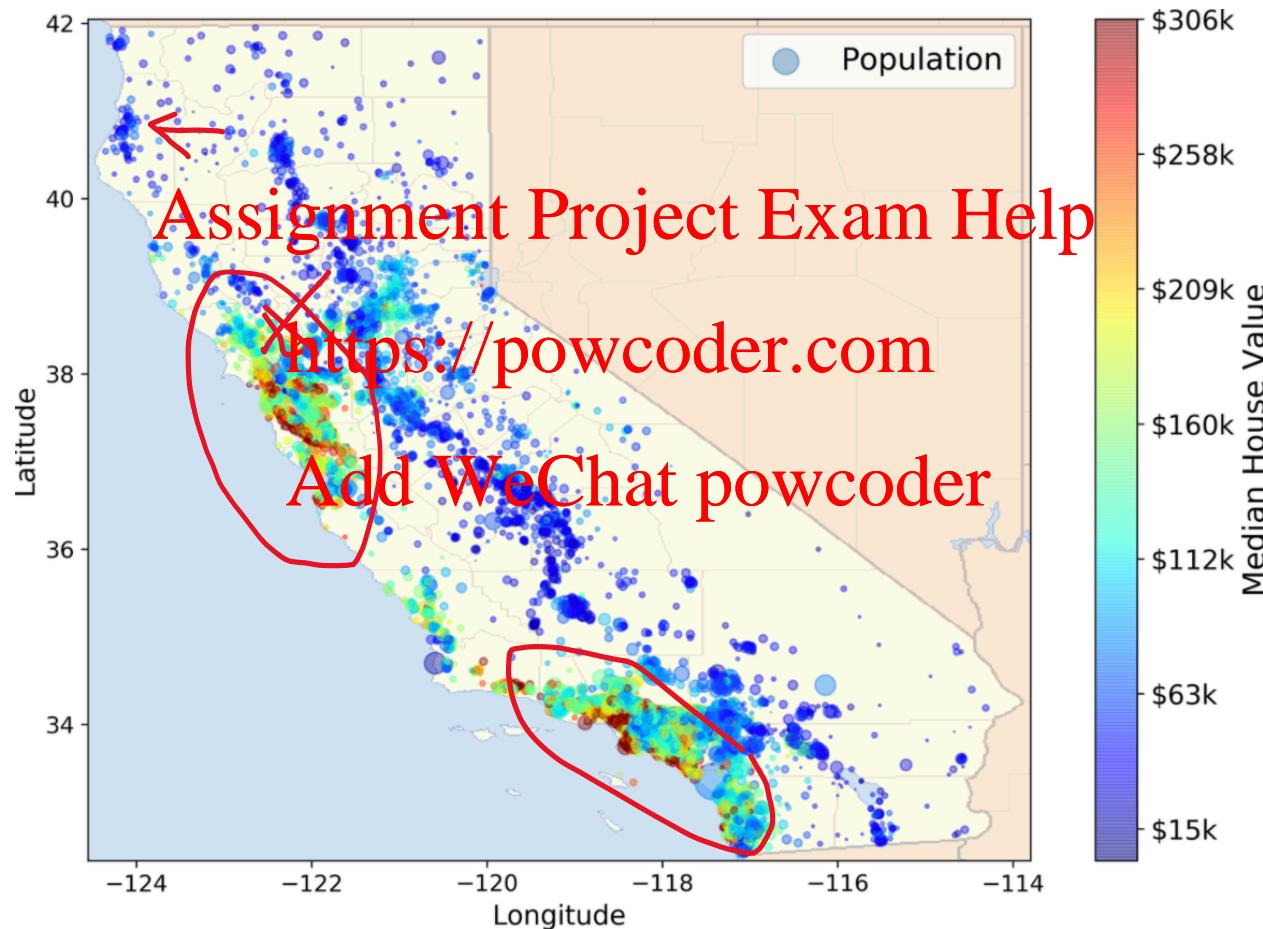
DISTRIBUTIONS



VISUALIZATION



CALIFORNIA HOUSING PRICES



- Discover
- Explore
- Visualize

- Clean
- Sample
- Impute
- Encode

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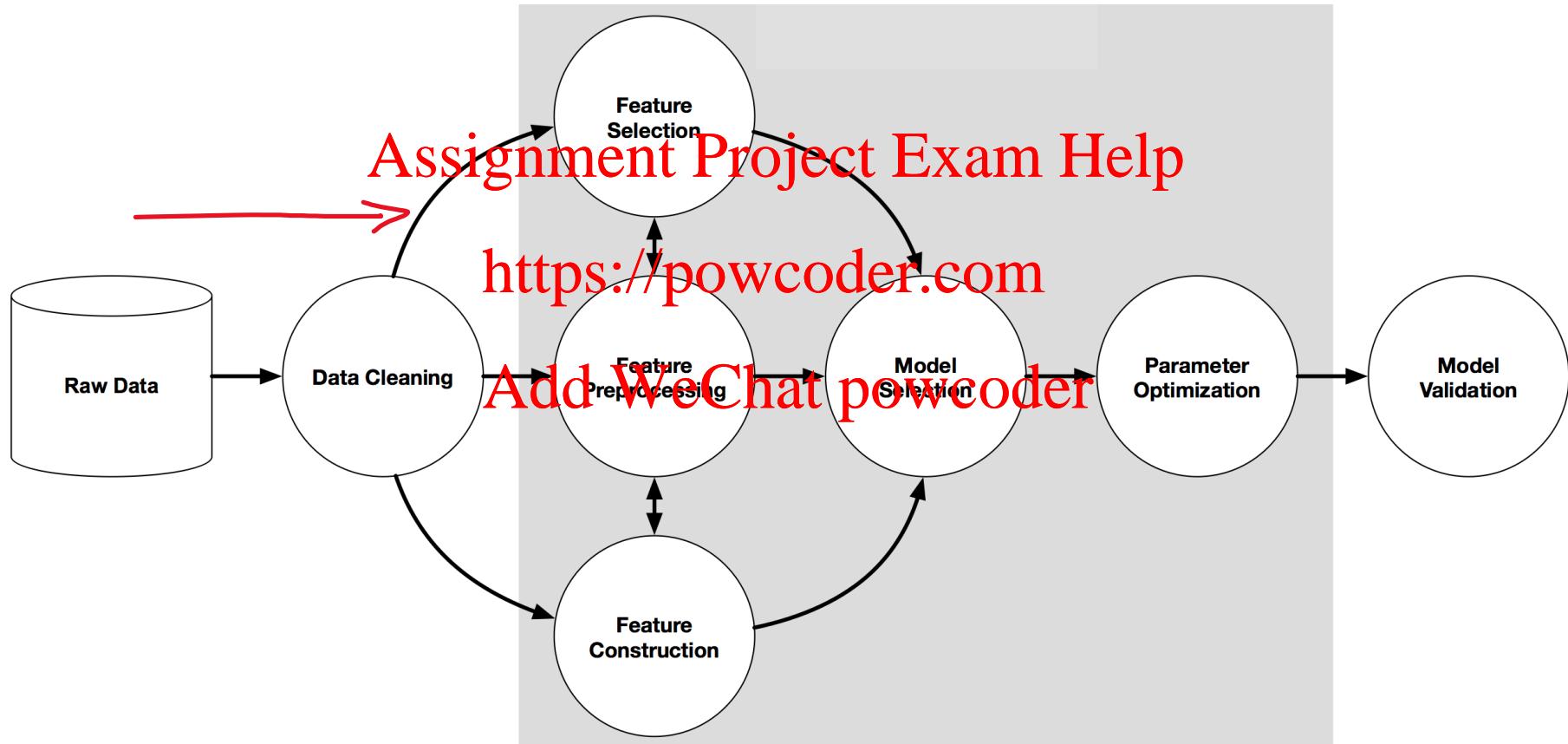
- Pipelines
- Training/Validation splits
- Modeling
- Tuning
- Error Analysis

- Documentation
- Presentation

- Launch
- Monitor
- Maintain

D → A → B

A B C D



The Machine Learning Canvas (v0.4)

Designed for:

Designed by:

Date:

Iteration:

Decisions  How are predictions used to make decisions that provide the proposed value to the end-user?	ML task  Input, output to predict, type of problem.	Value Propositions  What are we trying to do for the end-user(s) of the predictive system? What objectives are we serving?	Data Sources Which raw data sources can we use (internal and external)?  = ←	Collecting Data  How do we get new data to learn from (inputs and outputs)? →
Making Predictions  When do we make predictions on new inputs? How long do we have to featurize a new input and make a prediction?	Offline Evaluation  Methods and metrics to evaluate the system before deployment. —Add WeChat powcoder	Features Input representations extracted from raw data sources. 	Building Models  When do we create/update models with new training data? How long do we have to featurize training inputs and create a model?	
Live Evaluation and Monitoring  Methods and metrics to evaluate the system after deployment, and to quantify value creation.				

The Machine Learning Canvas (v0.4)

Designed for:

Machine Learning
Housing Corp.

Designed by:

T P MOORE

Date: 23/01/2020

Iteration: 1

Decisions	ML task	Value Propositions	Data Sources	Collecting Data
<p>How are predictions used to make decisions that provide the proposed value to the end-user?</p> <p><i>model output to be used in another ML system with other signals.</i></p> <p>- inform investment decision for area</p>	<p>Input, output to predict, type of problem.</p> <ul style="list-style-type: none"> - supervised - multivariate regression - batch training 	<p>What are we trying to do for the end-user(s) of the predictive system? What objectives are we serving?</p> <ul style="list-style-type: none"> - build a model & housing prices in California - predict the median housing price in any district <p><i>+ reduce manual error rate estimate</i></p>	<p>Which raw data sources can we use (internal and external)?</p> <p><i>California census data</i></p>	<p>How do we get new data to learn from (inputs and outputs)?</p> <p><i>Block groups - 300-6000 "districts" people</i></p>
Making Predictions	Offline Evaluation	Features	Building Models	Live Evaluation and Monitoring
<p>When do we make predictions on new inputs? How long do we have to featurize a new input and make a prediction?</p> <ul style="list-style-type: none"> - RMSE - MAE 	<p>Methods and metrics to evaluate the system before deployment.</p> <ul style="list-style-type: none"> ✓ ✗ 	<p>Input representations extracted from raw data sources.</p> <p><i>population median income (10) median age ... rooms per household bedrooms per room population per household</i></p>	<p>When do we create/update models with new training data? How long do we have to featurize training inputs and create a model?</p>	<p>Add WeChat powcoder</p> 

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