Department of Statistics and Actuarial Science

BACHELOR OF SCIENCE

Major in *Statistics*
Major in *Risk Management*
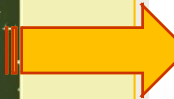Major in *Decision Analytics*

https://saasweb.hku.hk/

A theme underlying all 3 majors is...

STATISTICS

addresses an important human endeavour...

a desire to make "sense" of *observations*

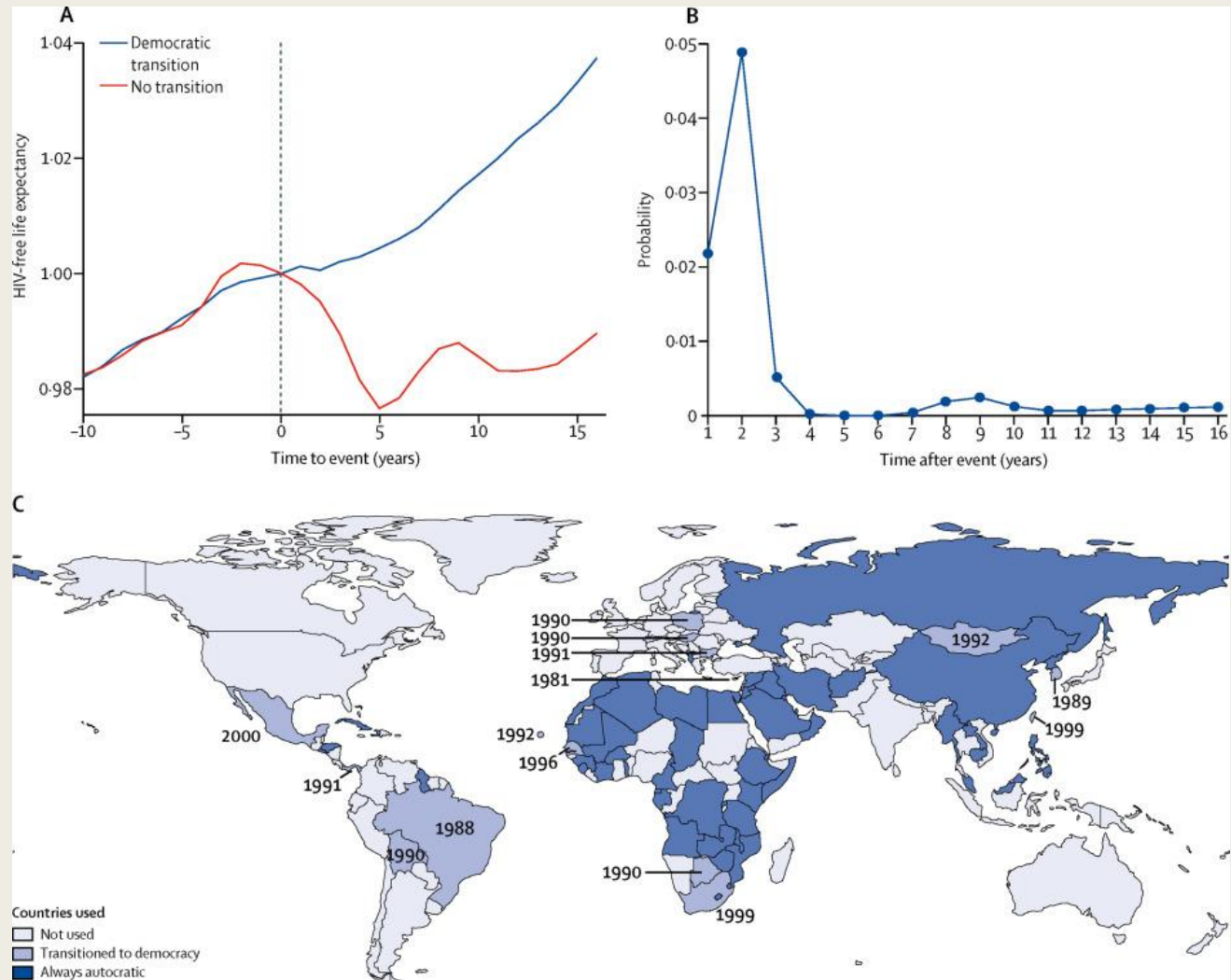STATISTICAL REASONING

THE LANCET

The relationships between democratic experience, adult health, and cause-specific mortality in 170 countries between 1980 and 2016: an observational analysis
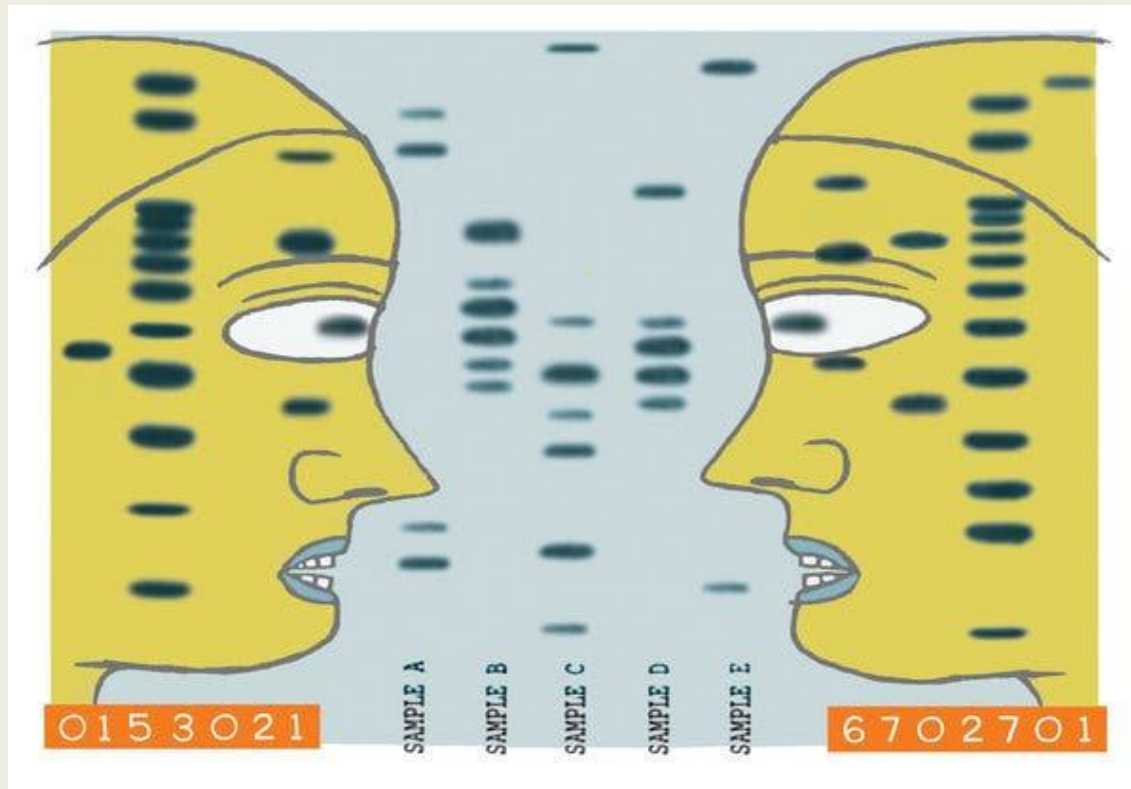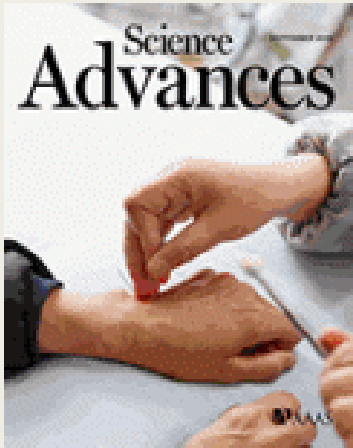
The New York Times

One Twin Committed the Crime — but Which One? A New DNA Test Can Finger the Culprit
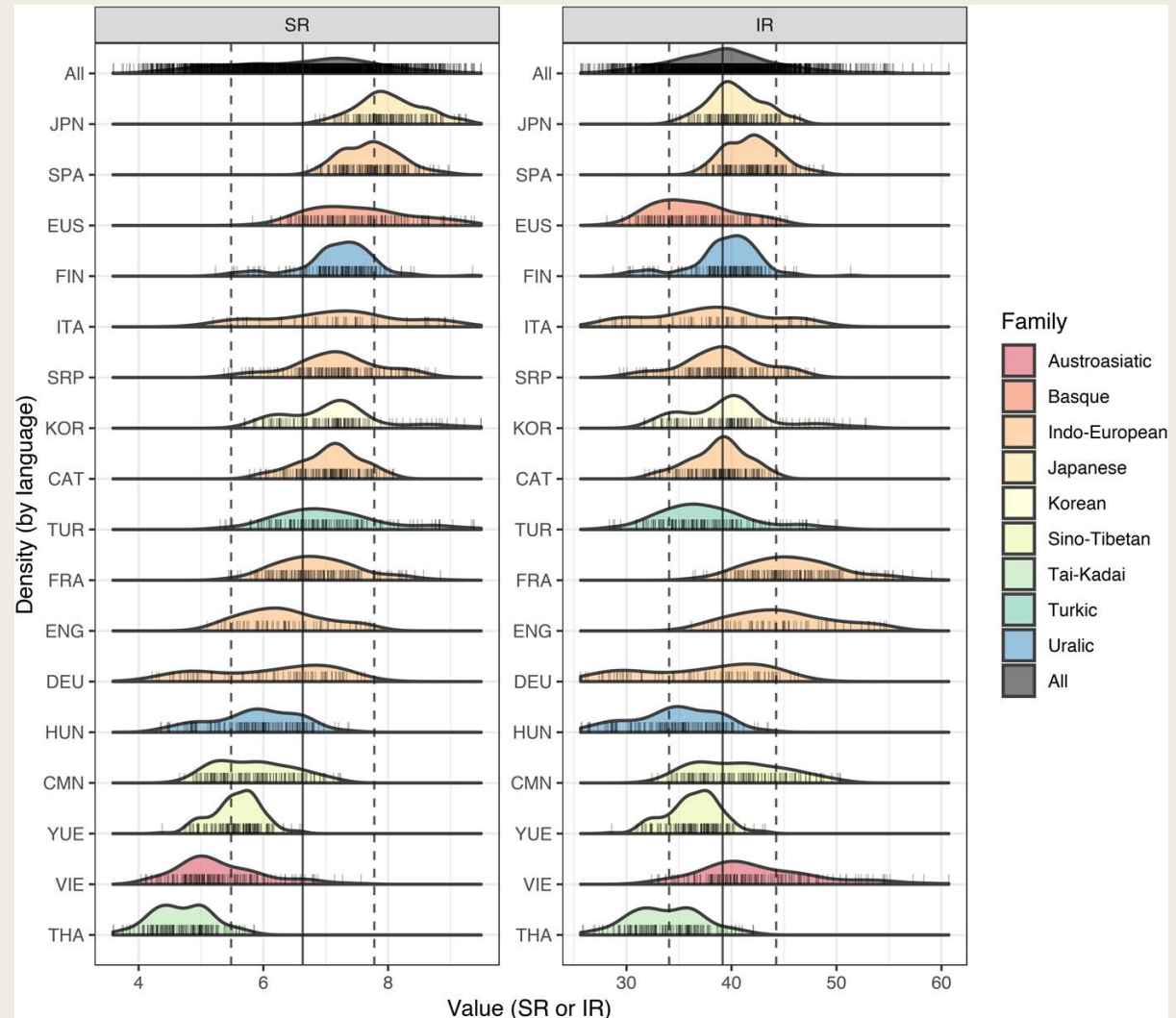
A handful of criminal prosecutions have stalled because DNA tests cannot distinguish between suspects who are twins. Then scientists decided to create one.

Different languages, similar encoding efficiency: Comparable information rates across the human communicative niche

Focus article

Computer vision, archaeological classification and China's terracotta warriors
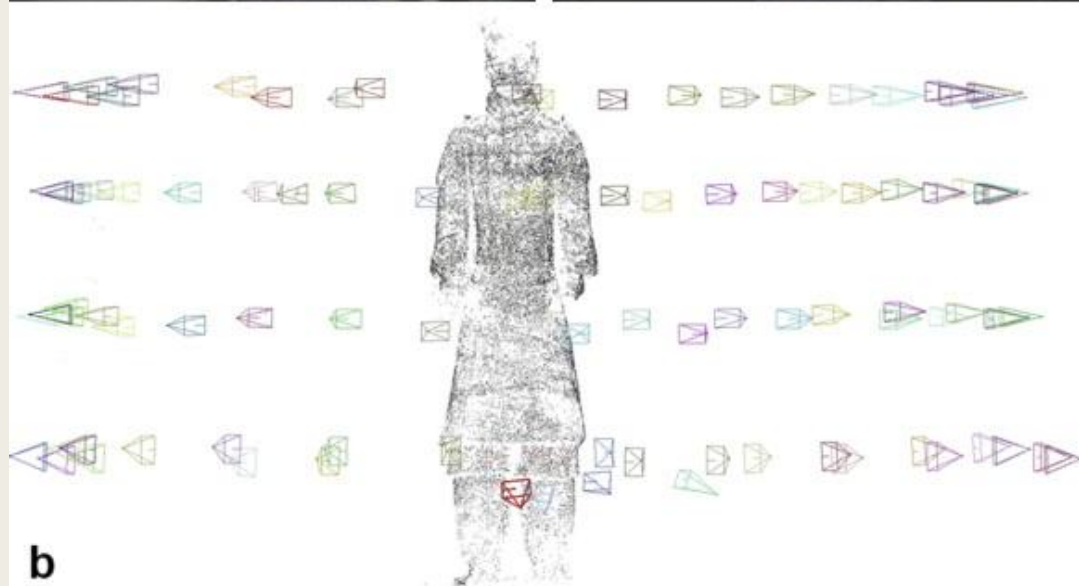
SCIENTIFIC DATA

A public data set of spatio-temporal match events in soccer competitions

Pass • Shot • Duel
Free Kick • Others on the ball - Acceleration • Others on the ball - Clerance
Pass Defender • Pass Forward • Pass Midfielder
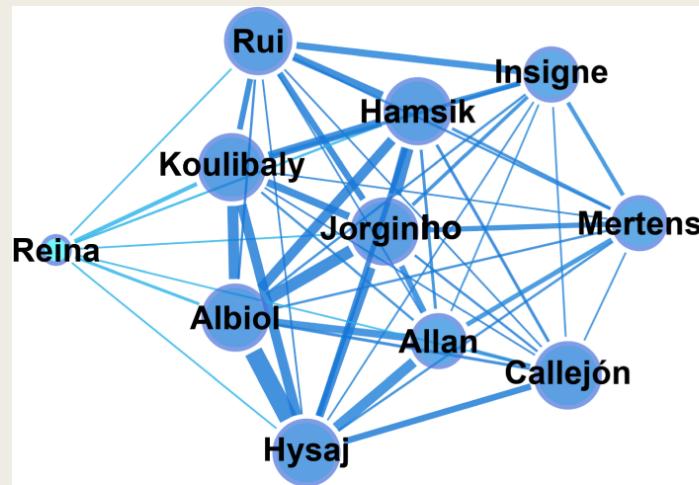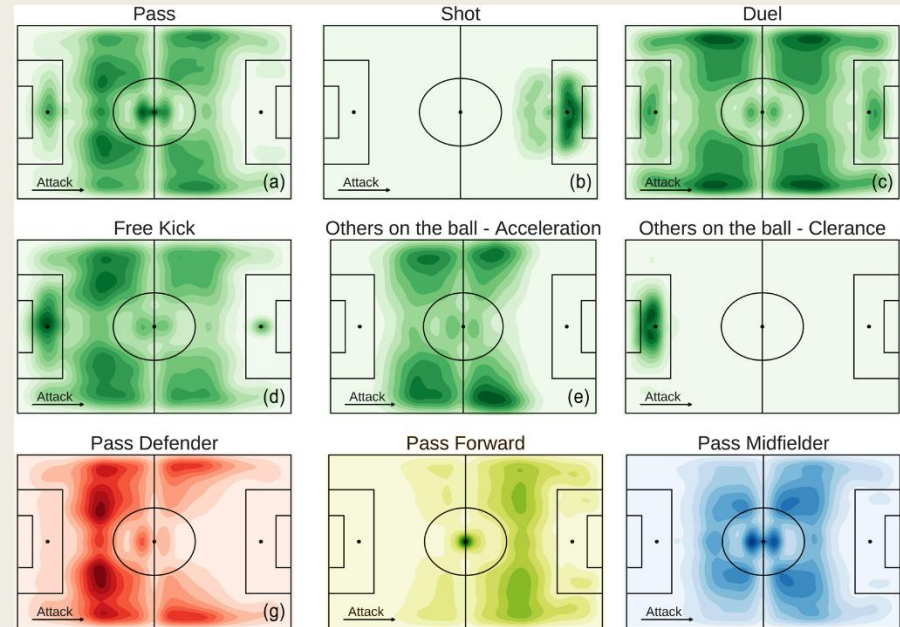
Napoli (0)
connectivity = 14.74
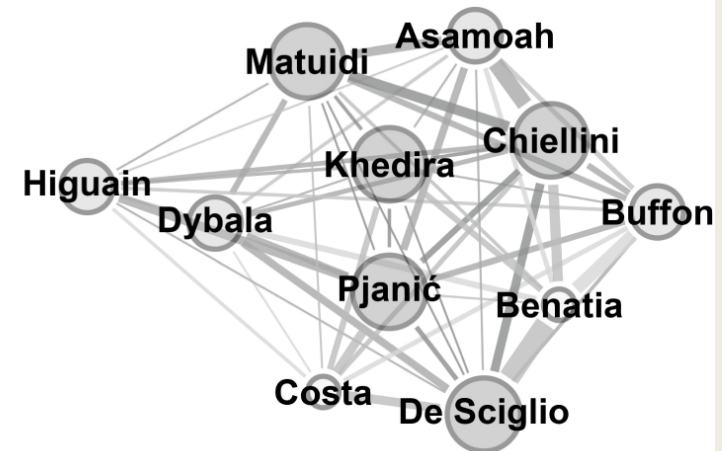
Juventus (1)
connectivity = 19.89

The Guardian

Aliens may not exist – but that's good news for our survival

A new study suggests that we could well be on our own in the universe. Yet loneliness might have its advantages
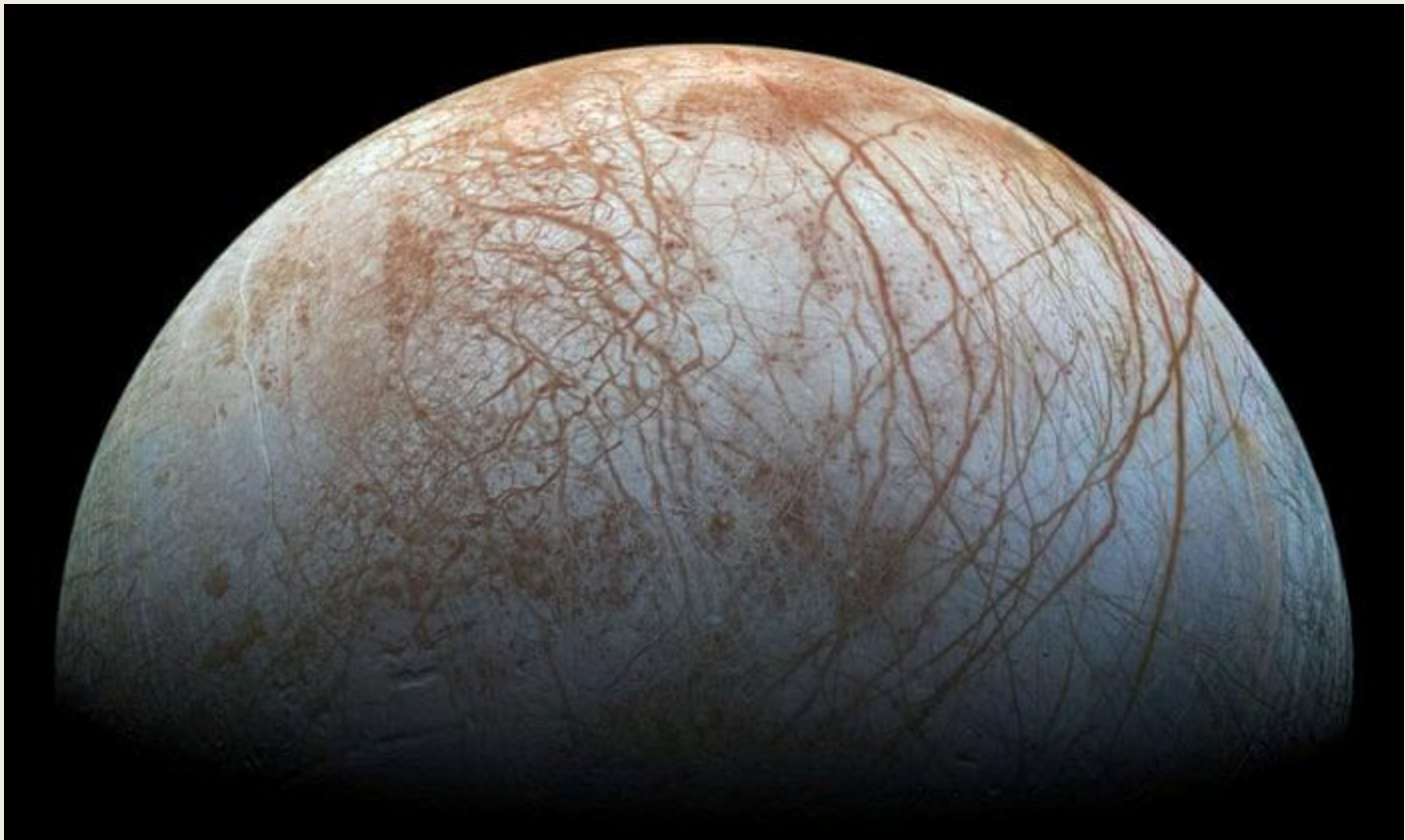
International Review of Financial Analysis
Volume 69, May 2020, 101377

ELSEVIER

The run-up to the global financial crisis:
A longer historical view of financial liberalization, capital inflows, and asset bubbles
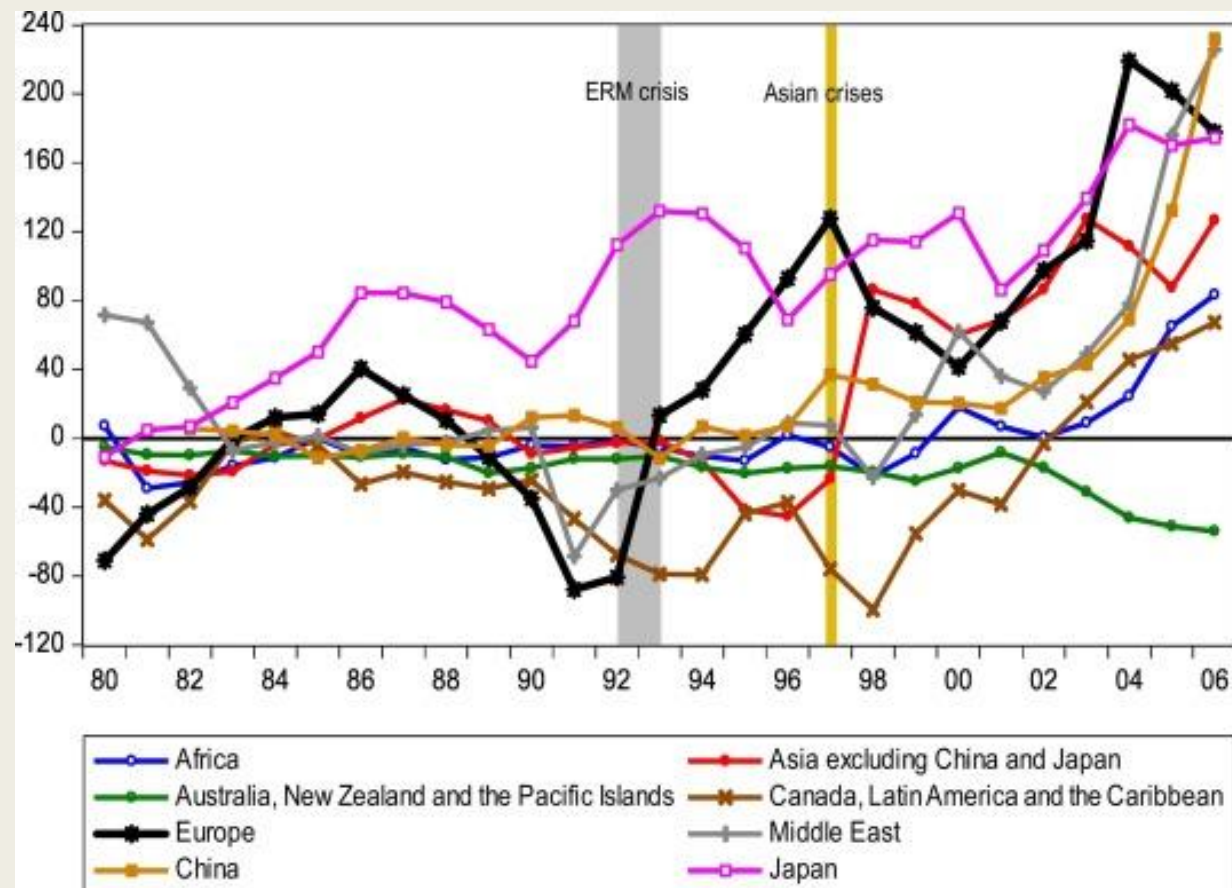
The Economist

Some days are more equal than others?
China, covid-19, 2020, new confirmed cases, by day

Hubei province

15,000

New party leadership
in Hubei and Wuhan

12,500

New diagnostic
guidelines issued

Guidelines
rescinded

10,000

7,500

5,000

2,500

0

January   February   March

All provinces, excluding Hubei

200

Zhejiang province
announces 335 new
clinics and backup hospital

Shandong provincial
justice department
chief removed

150

Xi Jinping
speech to
the politburo

100

50

0

January   February   March

Source: China's National Health Commission

The Economist

Major in DECISION ANALYTICS

DECISION ANALYTICS

addresses decisions for modern human …

a desire to make sense of "big data"
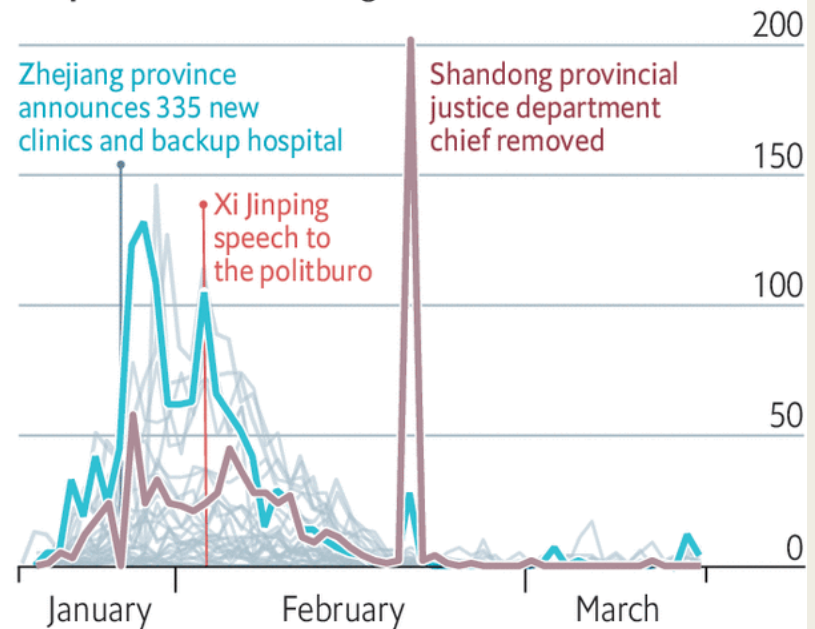
Netflix movie-rating challenge

17,770 movies
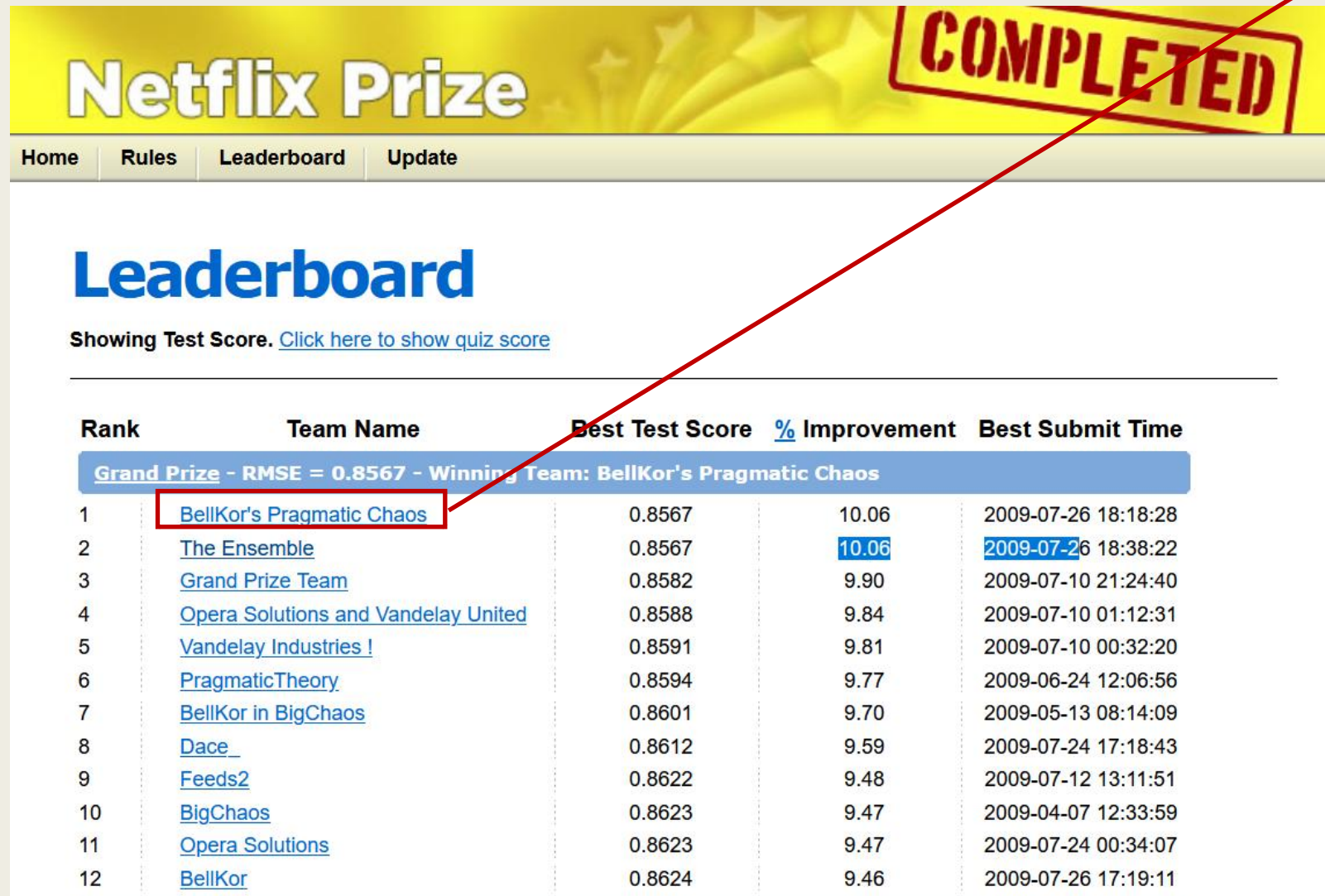
480,189 customers

	Dirty Dancing	Meet the Parents	Top Gun	The Sixth Sense	Catch Me If You	The Royal Tenen...	Con Air	Big Fish	The Matrix	A Few Good Men
Customer 1	•	•	•	•	4	•	•	•	•	•
Customer 2	•	•	3	•	•	•	3	•	•	3
Customer 3	•	2	•	4	•	•	•	•	2	•
Customer 4	3	•	•	•	•	•	•	•	•	•
Customer 5	5	5	•	•	4	•	•	•	•	•
Customer 6	•	•	•	•	•	2	4	•	•	•
Customer 7	•	•	5	•	•	•	•	3	•	•
Customer 8	•	•	•	•	•	2	•	•	•	3

How to predict missing ratings of customers?

… involved many statistical techniques, of which most important is SVD (Singular Value Decomposition)

Netflix Prize

COMPLETED

Home | Rules | Leaderboard | Update

Leaderboard

Showing Test Score. Click here to show quiz score

| Rank	Team Name	Best Test Score	% Improvement	Best Submit Time
Grand Prize - RMSE = 0.8567 - Winning Team: BellKor's Pragmatic Chaos				
1	BellKor's Pragmatic Chaos	0.8567	10.06	2009-07-26 18:18:28
2	The Ensemble	0.8567	10.06	2009-07-26 18:38:22
3	Grand Prize Team	0.8582	9.90	2009-07-10 21:24:40
4	Opera Solutions and Vandelay United	0.8588	9.84	2009-07-10 01:12:31
5	Vandelay Industries !	0.8591	9.81	2009-07-10 00:32:20
6	PragmaticTheory	0.8594	9.77	2009-06-24 12:06:56
7	BellKor in BigChaos	0.8601	9.70	2009-05-13 08:14:09
8	Dace_	0.8612	9.59	2009-07-24 17:18:43
9	Feeds2	0.8622	9.48	2009-07-12 13:11:51
10	BigChaos	0.8623	9.47	2009-04-07 12:33:59
11	Opera Solutions	0.8623	9.47	2009-07-24 00:34:07
12	BellKor	0.8624	9.46	2009-07-26 17:19:11
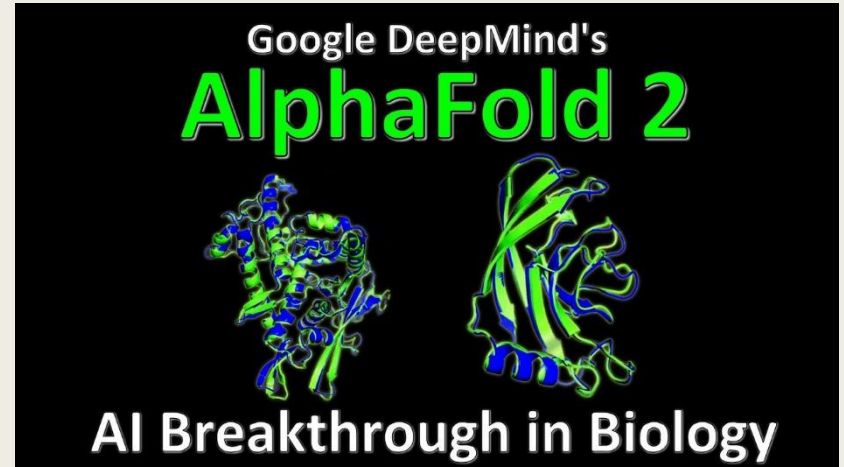
Step 1

Collect demonstration data, and train a supervised policy.

A prompt is sampled from our prompt dataset.

A labeler demonstrates the desired output behavior.

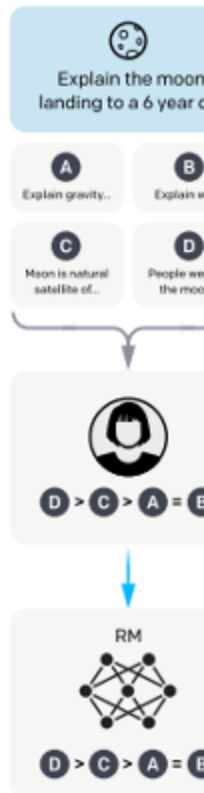This data is used to fine-tune GPT-3 with supervised learning.

Step 2

Collect comparison data, and train a reward model.

A prompt and several model outputs are sampled.

Explain the moon landing to a 6 year o

A Explain gravity...

B Explain w

C Moon is natural satellite of...

D People we the moon

A labeler ranks the outputs from best to worst.

D > C > A = B

This data is used to train our reward model.

RM

D > C > A = B

Step 3

Optimize a policy against the reward model using reinforcement learning.

A new prompt is sampled from the dataset.

Write a story about frogs

The policy generates an output.

PPO

The reward model calculates a reward for the output.

Once upon a time....

RM

The reward is used to update the policy using PPO.

r_k

Leverages Proximal Policy Optimization (PPO)

A policy is, a strategy that an agent uses in pursuit of goals

Kullback–Leibler penaltiy for SFT model to avoid overfitting

Major in RISK MANAGEMENT

RISK MANAGEMENT

a desire to make sense of, & manage, "risk"

■ **Risk Management** is a logical and systematic methodology of studying the risks involved in any activity or process.

Monitoring risk

Treating risk

Analyzing risk

Identifying risk

■ **Major Objectives of Risk Management:**

– *To avoid or minimize potential losses*

– *To help managers make best use of their available resources*

Professional Qualification

- **Financial Risk Manager (FRM) Certificate Exam**
  - *awarded by Global Association of Risk Professionals (GARP) http://www.garp.com (founded in 1996)*

- **Professional Risk Managers (PRM) Exam**
  - *awarded by Professional Risk Managers' International Association (PRMIA) http://www.prmia.org*

- **Chartered Enterprise Risk Actuary (CERA)**
  - *awarded by CERA Global Association https://ceraglobal.org*

RSS Accreditation

HKU has been awarded the status of an Accredited University by the Royal Statistical Society (RSS).

Upon completion of a bachelor degree programme at HKU with a major in either Statistics, Decision Analytics* or Risk Management* and application to RSS via the standard route, graduates are qualified to become a Graduate Statistician (GradStat) designated by RSS.

Accreditation with the Royal Statistical Society (RSS)

Accredited Major (*conditions)	Applicants must have completed and passed these specific courses
Major in Statistics	No additional requirement.
Major in Decision Analytics*	At least 3 Quality Marked (QM) Disciplinary Electives, one of which must include STAT4610, **and** at least one QM Capstone course.
Major in Risk Management*	STAT4610, **and** at least one of STAT3603, STAT3612, STAT3655 or STAT4601, **and** at least one QM Capstone course.

For BSc students admitted in 2024:

https://saasresearch.hku.hk/share/student/u2023/HKU_SAAS_RSS_QM_20240108.pdf

For BSc students admitted in 2023:

https://saasresearch.hku.hk/share/student/u2023/HKU_SAAS_RSS_QM_20240108.pdf

HKU Courses with RSS Quality Mark (QM)

Disciplinary Core Courses or Disciplinary Electives
STAT1600 Statistics: ideas and concepts
STAT2601 Probability and statistics I
STAT2602 Probability and statistics II
STAT3021 Modern biostatistics
STAT3600 Linear statistical analysis
STAT3602 Statistical inference
STAT3603 Stochastic processes
STAT3604 Design and analysis of experiments
STAT3606 Business logistics
STAT3607 Statistics in clinical medicine and bio-medical research
STAT3608 Statistical genetics
STAT3609 The statistics of investment risk
STAT3612 Statistical machine learning
STAT3613 Marketing analytics
STAT3615 Practical methods for investment
STAT3617 Sample survey methods
STAT3618 Derivatives and risk management
STAT3620 Modern nonparametric statistics
STAT3621 Statistical data analysis
STAT3622 Data visualisation
STAT3655 Survival analysis
STAT3911 Financial economics II
STAT4011 Natural language processing
STAT4601 Time-series analysis
STAT4602 Multivariate data analysis
STAT4603 Current topics in risk management
STAT4606 Risk management and Basel Accords in banking and finance
STAT4607 Credit risk analysis
STAT4608 Market risk analysis
STAT4609 Big data analytics
STAT4610 Bayesian learning

Capstone Courses
STAT3799 Directed studies in statistics
STAT4710 Capstone experience for statistics undergraduates
STAT4799 Statistics project

Difference in focus between the 3 majors

■ **Decision Analytics** –

  heavy emphasis on both **STATISTICS** *and* **COMPUTER SCIENCE**

■ **Risk Management** –

  courses focus primarily on business-related topics: e.g.

  investment, insurance, finance, banking, etc.

■ **Statistics** –

  courses cover wide range of topics with emphasis on

  "METHODS", their applications, and underlying theory.

Career Prospects - Statistics

Statistics students with strong theoretical background in statistical analysis and research potential are ready to apply quantitative skills in further study in diverse areas like medical study, social sciences, economics and others.

Examples of positions held by our students:

Chief Health Statistician, Senior Statistician, Statistical Analyst, Research Manager, Trader, Financial Data Analyst, Marketing Analyst Associate, Associate Officer (Business Intelligent), Research Officer, Global Data Analyst, Operation Engineer, Client Reporting Analyst, Index Analyst, Global Supply Planning Data Analyst, Client Due Diligence Specialist, Customer Service Officer, Assistant Environmental Consultant, Management Information System Analyst, ...

Career Prospects – Decision Analytics

Graduates from our Decision Analytics programme will consider a career path as a **data scientist**, or pursue further studies in statistics or computer science.

Examples of positions held by our students:

Data Scientist, Data Governance Officer, Data Analyst, Technology Consultant, Software Engineer, R&B Engineer, Big Data Analytics Modelling Analyst (Betting), Developer, …

Career Prospects – Risk Management

Risk Management students are well equipped with quantitative skills in statistical modelling and modern exposure in risk analysis. Most of them will work in the financial industry with further professional qualifications, and end up with senior management position after gaining years of experiences in risk analysis and training in investment, banking and financial institutions.

Examples of positions held by our students:

Director (specializing in FP&A), Associate Director in Global Markets, Personal Banking Officer, Corporate Banking Analyst, Consultant Banker, Insurance Data Analyst, Business Control and Research Manager, Operation Officer, Risk Management Officer, Investment Analyst, Business Specialist, Compliance Officer, Treasury Product Specialist, Government Executive Officer, Administrative Officer, Statistical Officer, …

U.S. News Best Jobs Rankings 2022

https://money.usnews.com/careers/best-jobs/rankings

Statistician
- **#3** in **Best Business Jobs**
- **#7** in **Best STEM Jobs**
- **#8** in **100 Best Jobs**

Data Scientist
- **#3** in **Best Technology Jobs**
- **#6** in **100 Best Jobs**
- **#6** in **Best STEM Jobs**

Actuary
- **#7** in **Best Business Jobs**
- **#11** in **Best STEM Jobs**
- **#20** in **100 Best Jobs**
- **#24** in **Best Paying Jobs**

Management Analyst
- **#6** in **Best Business Jobs**
- **#17** in **100 Best Jobs**

Market Research Analyst
- **#4** in **Best Business Jobs**
- **#14** in **100 Best Jobs**
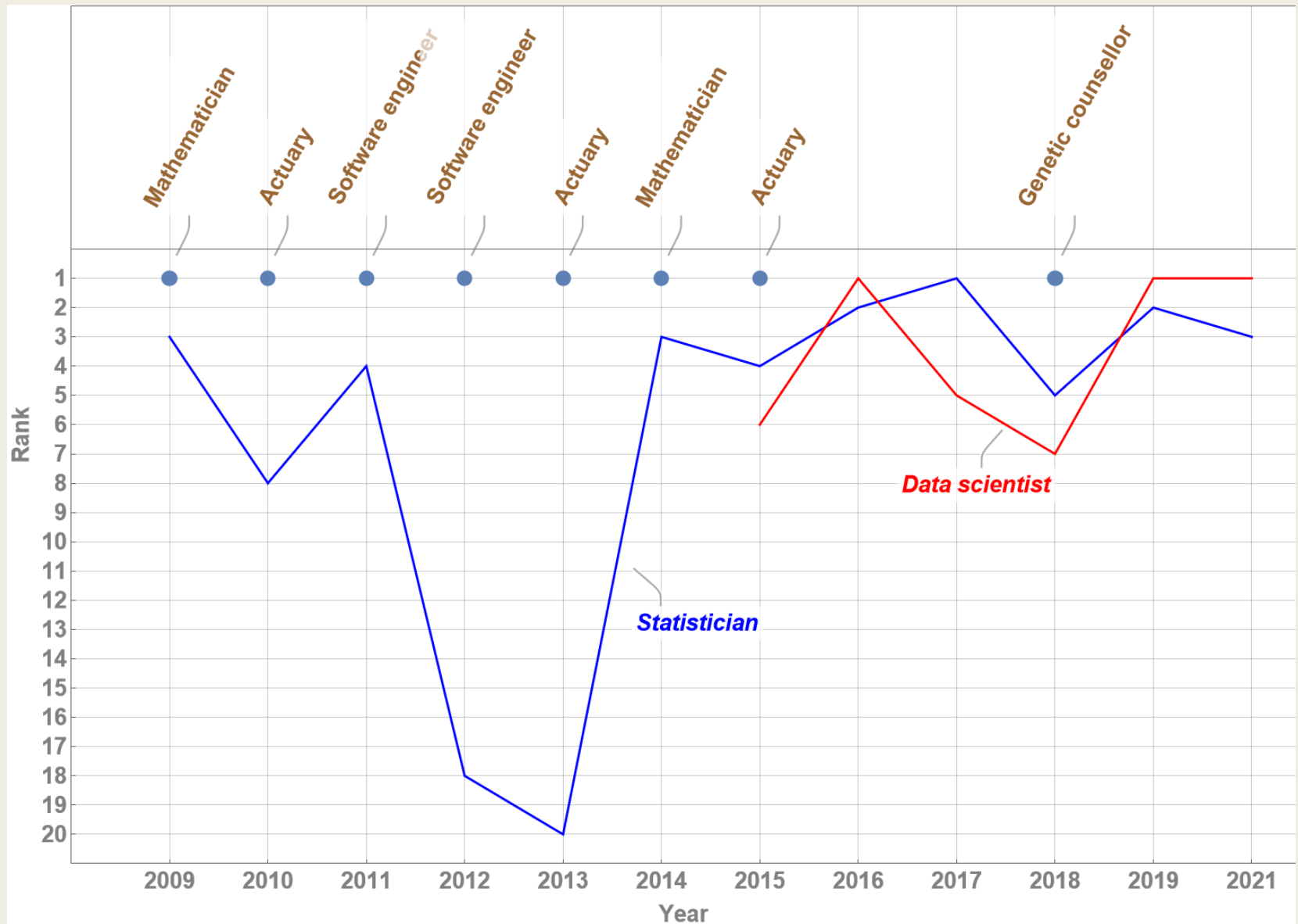
1. University Professor

Median Salary: $80,790

Post-secondary teachers tend to enjoy flexible schedules. While some teach classes at night or on weekends, these professionals generally find their jobs rewarding and appreciate the opportunity to share their expertise with students, according to the BLS. CareerCast ranked university professor as one of the careers with the lowest stress level in 2019, the most recent year the job website compiled its list.

In addition to teaching, university professors advise students and conduct research in their fields. While most positions require you to hold a Ph.D., a graduate degree might be sufficient for community colleges, according to the BLS.

5. Statistician

Median Salary: $92,270

If you're good with numbers, you might want to consider a career as a statistician. These individuals collect data to help solve problems in a variety of industries and generally work full time. They could need to work overtime to meet a deadline or fill a last-minute request for information.

Job growth for this profession is currently high, as an increasing number of businesses are using statistical analysis to make decisions, according to the BLS. Most opportunities require candidates to hold master's degrees in statistics, mathematics or similar fields.

9. Mathematician

Median Salary: $110,860

Mathematicians utilize techniques to solve problems in business, engineering and other fields. U.S. News ranked mathematician as the sixth-best job in business in 2021 and noted that mathematicians enjoy a variety of professional opportunities.

To qualify for a mathematics position, you'll need at least a bachelor's degree in math. Some positions require further education.

10. Actuary

Median Salary: $111,030

An actuary analyzes the financial costs of risks taken by businesses and clients. However, pursuing a career as an actuary involves little risk and plenty of rewards. South Dakota State University touts the profession for its "high pay, low stress, good job security" and contribution in solving important problems.

Actuaries commonly hold bachelor's degrees in math or related analytical fields. Additional certification is needed to achieve full professional status.

10 well paid jobs that are relatively low stress:

1.Statistician

2.Dental Hygienist

3.Librarian

1. Statistician

Glassdoor Average Salary: £39,473

Statisticians use mathematical techniques to interpret data to draw parallels or to come to conclusions. Statisticians can work across various sectors, including public, private and academic. Freelance statisticians - those who are self-employed and work on a project basis, are in high demand.

Using logical thinking, combined with mathematical techniques to draw facts from raw data, statisticians can work solo or in a collaborative team. Having this option means, being a statistician is a relatively low-stress job.

An interest in mathematics and the ability to understand complex mathematical functions is important. When hiring, employers look for candidates who have a degree in maths or a related subject.

A few practical reasons for majoring in

Statistics / Risk Management / Decision Analytics

- Flexibility of the programme enables you to tailor-make your course of study.

- Develop your interest at your own pace.

- Pre-mature commitment not required.

Mathematical background adequate?

Students must have <u>level 2 or above</u> in

- HKDSE Extended Module 1 or 2 of Mathematics or equivalent

Otherwise, strongly advised to take

<u>MATH1011 University Mathematics I</u>

in Semester 1.

What do we need from your Mathematics?

- Set notation and theory

- Functions (*incl.* limits, continuity)

- Sequences, series

- Basic calculus (*incl.* partial differentiation, double integration)

- Vectors, matrices (basic operations)

New changes to curricula

Major in *Statistics*

Disciplinary Electives (36 credits)
At least 36 credits from Lists A and B, among which at least 18 credits from List A:
List A
STAT3602   Statistical inference (6)
STAT3603   Stochastic processes (6)
STAT3620   Modern nonparametric statistics (6)
STAT3621   Statistical data analysis (6)
STAT3655   Survival analysis (6)
STAT4601   Time-series analysis (6)
List B
STAT3604   Design and analysis of experiments (6)
STAT3606   Business logistics (6)
STAT3607   Statistics in clinical medicine and bio-medical research
                   (6)
STAT3608   Statistical genetics (6)
STAT3612   Statistical machine learning (6)
STAT3613   Marketing analytics (6)
STAT3617   Sample survey methods (6)
STAT4610   Bayesian learning (6)

Disciplinary Electives (36 credits)
At least 36 credits from Lists A, B and C, among which at least 6 credits from List A, at least 12 credits from List B and at least 6 credits from List C:
List A
STAT3602   Statistical inference (6)
STAT3621   Statistical data analysis (6)
STAT4610   Bayesian learning (6)
List B
STAT3603   Stochastic processes (6)
STAT3612   Statistical machine learning (6)
STAT3620   Modern nonparametric statistics (6)
STAT3655   Survival analysis (6)
STAT4601   Time-series analysis (6)
List C
STAT3021   Modern biostatistics (6)
STAT3604   Design and analysis of experiments (6)
STAT3606   Business logistics (6)
STAT3607   Statistics in clinical medicine and bio-medical research
                   (6)
STAT3608   Statistical genetics (6)
STAT3613   Marketing analytics (6)
STAT3617   Sample survey methods (6)

Reminder

- plan ahead

  - ➢ major/minor, overseas exchange, internship, research project

  - ➢ career vs further study

- watch out for pre-requisites of individual courses

- courses **CANNOT** be double-counted to fulfill different majors/minors

  - ➢ (exception for double major in Science: SCNC1111 & SCNC1112 & up to 12 credits of compulsory courses REQUIRED by both Science majors can be double-counted)

- consult course selection advisors if necessary

Support from University and Department

- **HKU :** Centre of Development and Resources for Students

  - *NETmatch, NETjobs, JIJIS (Joint Institutions Job Info. System)*

- **Department :** Internship / Job Online Application System

Career Development Training

- **Summer IT course:**

  – *Essential IT skills (certificate course)*

- **Career Advising Programme (CAP) to prepare students for:**

  – *internships and job opportunities*

  – *advancing resume and interview skills*

Besides career…

■ Opportunity for further studies

– Recently our graduates had pursued Masters and PhD studies in universities including Harvard, UC Berkeley, Yale, Stanford, Cambridge

■ Scholarships/Awards

■ Other learning opportunities

(e.g. overseas exchange, mentorship, internship, research projects)

Contact Persons

- Co-ordinators & Course Selection Advisors
  - *Chen Wang (Statistics)*
  - *Yuan Cao (Decision Analytics)*
  - *K P Wat (Risk Management)*
- Credit transfer
  - *Chen Wang*
- Internship
  - *Eric Li*
- Tel: 3917 2466
- Email: ugenq@hku.hk

QUESTION AND ANSWER

Our Homepage: www.hku.hk/statistics