課程名稱: **統計科學** (Statistical Science)

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評分標準: 上課出缺席 10%，作業 30%、期中考: 30%、期末考: 30%
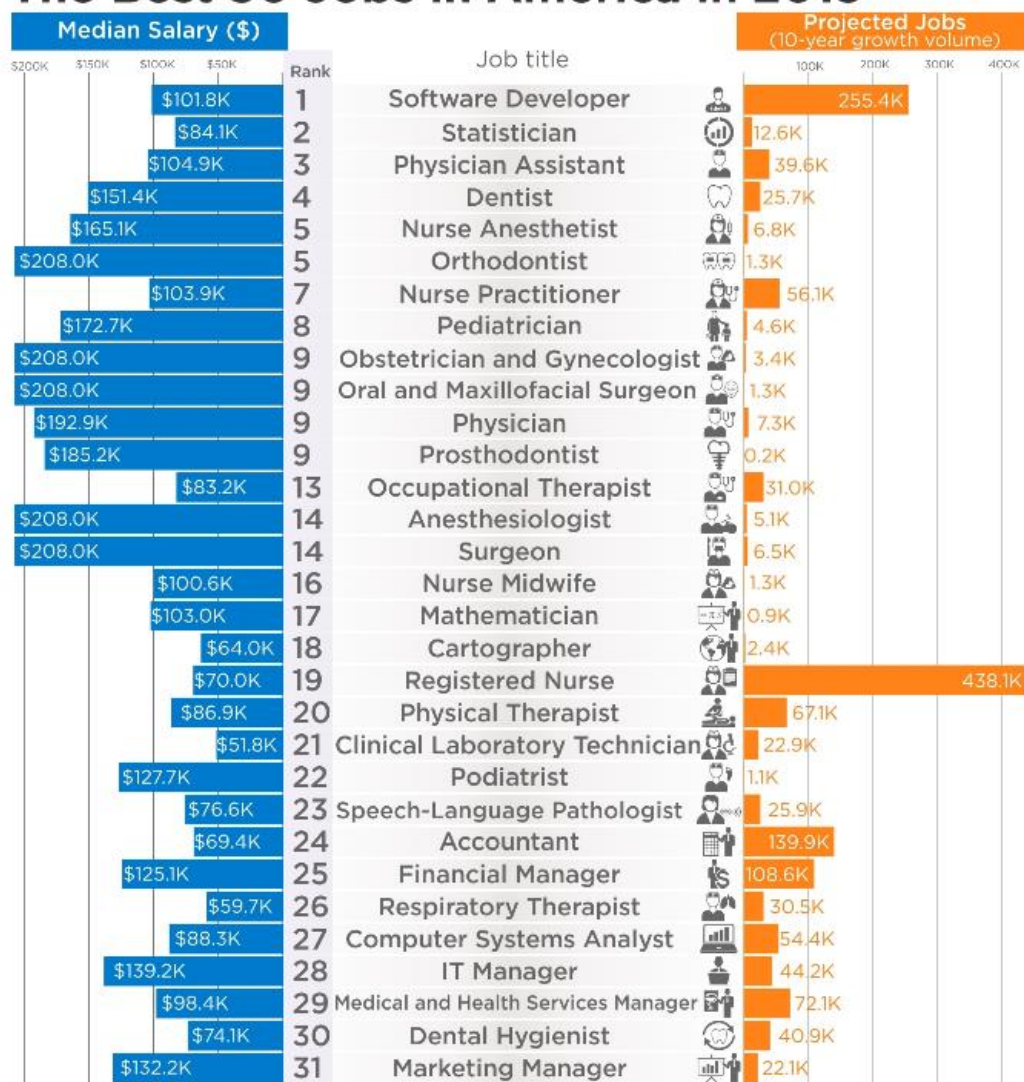
參考用書:
 Introduction to Mathematical Statistics 8th
 Hogg Robert, McKean Joseph and Craig Allen
 與上課筆記

The Best 50 Jobs in America in 2019

Median Salary ($)	Rank	Job title	Projected Jobs (10-year growth volume)
$101.8K	1	Software Developer	255.4K
$84.1K	2	Statistician	12.6K
$104.9K	3	Physician Assistant	39.6K
$151.4K	4	Dentist	25.7K
$165.1K	5	Nurse Anesthetist	6.8K
$208.0K	5	Orthodontist	1.3K
$103.9K	7	Nurse Practitioner	56.1K
$172.7K	8	Pediatrician	4.6K
$208.0K	9	Obstetrician and Gynecologist	3.4K
$208.0K	9	Oral and Maxillofacial Surgeon	1.3K
$192.9K	9	Physician	7.3K
$185.2K	9	Prosthodontist	0.2K
$83.2K	13	Occupational Therapist	31.0K
$208.0K	14	Anesthesiologist	5.1K
$208.0K	14	Surgeon	6.5K
$100.6K	16	Nurse Midwife	1.3K
$103.0K	17	Mathematician	0.9K
$64.0K	18	Cartographer	2.4K
$70.0K	19	Registered Nurse	438.1K
$86.9K	20	Physical Therapist	67.1K
$51.8K	21	Clinical Laboratory Technician	22.9K
$127.7K	22	Podiatrist	1.1K
$76.6K	23	Speech-Language Pathologist	25.9K
$69.4K	24	Accountant	139.9K
$125.1K	25	Financial Manager	108.6K
$59.7K	26	Respiratory Therapist	30.5K
$88.3K	27	Computer Systems Analyst	54.4K
$139.2K	28	IT Manager	44.2K
$98.4K	29	Medical and Health Services Manager	72.1K
$74.1K	30	Dental Hygienist	40.9K
$132.2K	31	Marketing Manager	22.1K

醫療影像 AI

根據臺北榮總今年4月最新統計的AI輔助診斷成果顯示，DeepMets判讀腦轉移瘤的準確率，已從先前的80％提高至95％以上。臺北榮總希望未來通過測試和法規核准後，能有機會大規模部署於其他醫療院所。

傳統人工標記腫瘤 傳統標記MRI腫瘤位置，有賴醫生手動檢視數百張MR影像，一張張圈選位置（圖中手指處），全部完成後，電腦才能進一步估算腫瘤大小。 攝影 / 洪政偉

AI輔助判讀腫瘤 醫生可以直接從PACS系統中，將資料傳送到DeepMets系統進行判讀，只要30秒就能標示出病灶（如圖綠色框線），並計算出腫瘤體積。 攝影 / 洪政偉

AI 人臉辨識、保全系統、語音辨識

動態刷臉新時代

決策理論

- A lot of N items, n ($n < N$) of which are sampled randomly and determined to be either defective or nondefective.
  - p: proportion of the N items that are defective (parameter)
  - $\hat{p}$: proportion of the n items that are defective (observed data, the distribution of $\hat{p}$ depends on p)
- For any lot, the manufacturer has two possible actions:
  - **sell the lot**, for a price \$M with a guarantee that if $p > p_0$ the manufacturer will pay a \$P penalty,
  - **junk it** at a cost \$C.
- The loss function is

State of Nature	Sell	Junk
$p \le p_0$	$-\$M$	$\$C$
$p > p_0$	$\$P$	$\$C$

Question:

For best profit, **how to make a decision** (sell or Junk) based on the observed data $\hat{p}$?

主要課程內容概要

(1) Survey sampling:
Simple random sampling

(2) Probability and Distribution
(a) Random Variable and Transformations

(b) Mean, Variance, Delta Method

(c) Some Commonly Used Distributions

(3) Point Estimation
(a) Method of Moments

(b) **Maximum Likelihood Estimator (M.L.E)**

(c) Asymptotic theory for method of moment estimator and M.L.E

(4) Data reduction
(a) Sufficient and Complete statistic

(b) Unbiased, Efficiency and Mean Square Error

(c) Rao-Blackwell theorem, Cramer-Rao inequality and UMVUE

(5) Interval Estimation
(a) Pivotal quantity and Confidence Intervals

(b) Asymptotic confidence intervals and Bootstrap Confidence Interval

(c) Sample size determination

(6) Hypothesis testing
(a) Type I error, Type II error, and P-value

(b) Likelihood ratio tests

(c) Neyman Pearson Lemma