

提升學生學習動機：競賽式課內期末專題

Hsuan-Tien Lin (林軒田)
htlin@csie.ntu.edu.tw

Department of Computer Science
& Information Engineering

National Taiwan University
(國立台灣大學資訊工程系)



My Two Classes with Competition-Based Final Projects

Machine Learning

elective (junior+)

- 2008
- 2009
- ...
- 2014 (7 years)

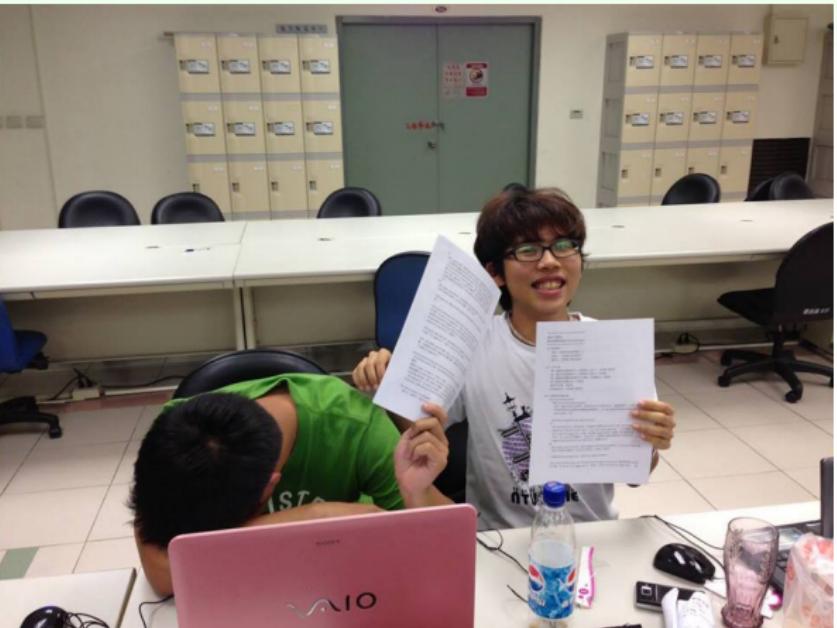
Data Structures & Algorithms

required (freshmen)

- 2011
- 2012
- ...
- 2015 (5 years)

Students' Reactions (Selected)

Scoreboard - MultiProject						
	Team Name	Algorithm	Run Time	Memory Use	Accuracy	Time
Ordered by accuracy						
1	longlife	d-f&r	1.165000	2249162	1.000000	2013-06-26 10:42:43
2	RabbitSynthesis	weighted k-domination in distance hereditary graph	2.320000	2249162	1.000000	2013-06-26 10:45:09
3	20130626_1	20130626_1	3.420000	2249162	1.000000	2013-06-26 10:45:29
4	DivideAndConquer	廣度優先	4.429000	2249162	1.000000	2013-06-26 10:47:26
5	TangleDominator	圖論-最短距離	4.463000	2249162	1.000000	2013-06-26 10:47:47
6	Final_count_down	字符串暴力解題	5.420000	1827116	1.000000	2013-06-26 10:47:50
7	Hypercube	7維魔術方塊	5.470000	1827116	1.000000	2013-06-26 10:47:56
8	Ula	Ula	6.130000	2249162	1.000000	2013-06-26 10:47:59
9	NTU_MultiProject		6.360000	2249162	1.000000	2013-06-26 10:47:57
10	IVC_TOLSET		7.473000	2249162	1.000000	2013-06-26 10:51:05
11	Japhne		8.540000	2249162	1.000000	2013-06-26 10:51:55
12	lambert	lambda	9.830000	2249162	1.000000	2013-06-26 10:52:27
13	X	ULTRA 7.7333	11.417000	2249162	1.000000	2013-06-26 10:57:45
14	Min_Cat		11.809000	2249162	1.000000	2013-06-26 10:58:35
15	Dikbar11110001	25-way tree	15.545000	1077962	1.000000	2013-06-26 10:58:52
16	Tall_and_Mature_0_0	bt	17.727000	2249162	1.000000	2013-06-27 00:06:38
17	optimal	optimal	18.789000	2249162	1.000000	2013-06-27 00:07:09
18	optimal	Faster_Preface	20.373000	2249162	1.000000	2013-06-27 00:11:38
19	Forvariations		20.580000	2249162	1.000000	2013-06-26 10:59:42
20	malopeps	big board	20.643000	2249158	1.000000	2013-06-24 23:02:42
21	HandwrittenFeedback		20.741000	2249162	0.962000	2013-06-26 10:59:54
22	lambert	lambda	21.510000	2249162	0.750000	2013-06-26 10:59:40



游靖堂、宋彥頽，2013.06.27

Students' Reactions (Selected)



游靖堂、宋彥頡，2013.06.27

好幾個晚上Debug或是寫新的算法and結構
甚至在考離散前一晚趕著競賽結束前趕工到四點
爆肝了好幾回

就是爲了這個.....DSA Final Project!!!!

從第一次的submission 75%, 46秒(只做指令c)

到現在最後一次的submission 100%, 4秒

中間經過了180幾次的變化

從40幾秒進步到10秒(再加上-O2瞬間又降爲4秒)

從2249162Byte 變成1499446Byte

從陣列+二分搜變成Trie+Binary Search Tree

大回顧20天的努力終於.....完成了!!!!

Students' Reactions (Selected)



游靖堂、宋彥頡，2013.06.27

coding的過程當中也越來越熟悉class

很可惜沒能成功手爆AVL Tree代替BST

很可惜沒能在競賽結束前知道-O2的厲害很可惜.....

能這樣彙整所有的spell checker功能

還很迅速的把完全沒學過，甚至coding前根本不知道它的名字的Trie
CO出來

自己都不由的覺得自己好罩((((逃XDDDDDDDD

趴尼游靖堂雖然很嘴砲 但他也很罩阿很多想法完全靠他

還有洪湧Cheng Yueh Han Han W神一直遙遙領先

也是讓我們想要力爭上游的進步動力

不管競賽結果如何或是Final Project Report的分數如何我想我們已經盡
力了

Students' Reactions (Selected)

- 個人覺得最高明的地方還是final project的competition，這玩意兒實在高明，寫到根本上癮，讓人想一寫在寫，快還要更快，小還要更小，尤其是被其他對手超過的驚訝感，甚至讓人很想放棄其他科的期末全力寫出超猛程式—DSA2013
- Final Project真的太誘人了……已經快期末考了每天卻還是忍不住去改它一下戳它一下電它一下—DSA2013
- 去年都再寫這個然後微積分就QQ了—DSA2012
- 學了好多，final的實做思考了很多東西，很爽—ML2014
- 關於final project，我自己是被打擊得挺厲害的，因為，看別組的正確率都那麼高，我們則雖然用了weka，卻連演算法都跑不完—ML2013

Excitement of Competition

史丹佛這樣教創新

http:

//www.cw.com.tw/article/article.action?id=5059685

「第六、鼓勵學生競賽。從來沒有一件事像「競爭」這樣，能讓人廢寢忘食、24小時工作絲毫不倦。我們鼓勵學生參加各式各樣的國際競賽，我們的學生蓋了一間太陽能屋，做電動車、機器人，參加DARPA(國防高等研究計劃署)挑戰賽，也參加企業營運書的競賽。」

Another “In-Class” Competition: KDD Cup

Background

- an annual competition on KDD (knowledge discovery and data mining)
- organized by ACM SIGKDD, starting from 1997, now **the most prestigious data mining competition**
- usually lasts 3-4 months
- participants include famous research labs (IBM, AT&T) and top universities (Stanford, Berkeley)

KDD Cups: 2008 to 2013 I

2008

- organizer: Siemens
- topic: breast cancer prediction (medical)
- data size: 0.2M
- teams: > 200
- NTU: **co-champion** with IBM (led by Prof. Shou-de Lin)

2009

- organizer: Orange
- topic: customer behavior prediction (business)
- data size: 0.1M
- teams: > 400
- NTU: **3rd place** of slow track

KDD Cups: 2008 to 2013 II

2010

- organizer: PSLC Data Shop
- topic: student performance prediction (education)
- data size: 30M
- teams: > 100
- NTU: **champion** and **student-team champion**

2011

- organizer: Yahoo!
- topic: music preference prediction (recommendation)
- data size: 300M
- teams: > 1000
- NTU: **double champions**

KDD Cups: 2008 to 2013 III

2012

- organizer: Tencent
- topic: web user behavior prediction (Internet)
- data size: 150M
- teams: > 800
- NTU: **champion of track 2**

2013

- organizer: Microsoft
- topic: paper-author relationship prediction (text mining)
- data size: 700M
- teams: > 500
- NTU: **double champions**

KDD Cup 2011



from

YAHOO![®]
LABS

Music Recommendation Systems

- host: Yahoo!
- 11 years** of Yahoo! music data
- 2 tracks** of competition
- official dates: **March 15 to June 30**
- 1878 teams submitted to track 1;
1854 teams submitted to track 2

NTU Team for KDD Cup 2011

- 3 faculties:
Profs. Chih-Jen Lin, Hsuan-Tien Lin and Shou-De Lin
- 1 course
Data Mining and Machine Learning: Theory and Practice
- 3 TAs and 19 students:
most were **inexperienced in music recommendation in the beginning**
- official classes: April to June;
actual classes: December to June

our motto: study state-of-the-art approaches
and then **creatively improve them**

Previously: How Much Did You Like These Movies?

<http://www.netflix.com>

(1M dollar competition between 2007-2009)

Get Recommendations (27) Rate Movies Movies You've Rated (5)

How much did you
like these movies?



The Wedding
Planner



How to Lose a Guy
in 10 Days



Sweet Home
Alabama



Pretty Woman



goal: use “movies you’ve rated” to
automatically

predict your **preferences** on future movies

My Other Motivations

I HATE exams
even more than my students.....

林軒田
2013年6月26日 ·

距離報告 deadline 還有兩天，DSA Final Project 現在已經有十八個以上的隊伍進入 Accuracy = 1 的境界，每年這個時候心裡都偷偷覺得小有成就感，覺得學弟妹們比我們之前要強多了。

將太的壽司全國大賽篇中有一頁一直令我很印象深刻：看不見的老裁判交代說「把原來的題目換掉，我要為那個少年準備更適合他的題目」。DSA 的每次作業與 project 都讓我有進入那個角色的感覺。

大家請繼續加油！

ScoreBoard
MAIN.LEARNER.CSIE.NTU.EDU.TW

1015770....jpg

My Other Motivations

勿



林軒田

2014年5月28日 · 台北市 · 人▼

這是剛看到的 DSA github 裡頭，某個 team 的 commit log:

「該開會囉! 5/28 微積分課完 不准要廢 不然剁你_____」

_____是我加上的馬賽克.....

(1) 林軒田 - 每到學期末，最喜歡的就是看 final project competition... - Google Chrome
https://www.facebook.com/hsuantien/posts/1015770...ipa



林軒田

2012年6月16日 · 台北市 · 人▼

每到學期末，最喜歡的就是看 final project competition 了，比溫布頓還好看。始終相信資訊系的大一同學潛力是無限的.....在一個已經有點接近研究所等級IR難度的 final project 裡，已經有好幾個組都能達成非常非常有效率的正確查詢動作了.....

<http://main.learner.csie.ntu.edu.tw/.../scoreboardeachteam.php>

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聊天室(162)

My Design: Time Line

key dates:

- report due (i.e. overall competition end): as late as possible
—often **4 days before I need to submit the scores to NTU**
- award ceremony (i.e. early competition end): usually **last class**
- announcement: best timing to be **right after midterm**
—but may highly depend on TAs' schedule
- start designing: **two or more weeks before** announcement

尋人、地點和事物

林軒田
2014年12月1日 · 台北市 ·

機器學習比賽今天中午開跑

<https://learner.csie.ntu.edu.tw.../ml14fa.../fpt0p0/scoreboard/>
<https://learner.csie.ntu.edu.tw.../ml14fa.../fpt1p0/scoreboard/>

大家加油，看看要過多久才會有勝過 TA 的隊伍出現！

learner.csie.ntu.edu.tw

My Design: Story/Topic

an interesting story makes the competition exciting!

- ML2014:

In this final project, you are going to be part of an exciting machine learning competition. Consider a startup company that features a coming product on the mobile phone. The core of the product is a robust character recognition system..... To win the prize, you need to fight for the leading positions on the score board. Then, you need to submit a comprehensive report that describes not only the recommended approaches, but also the reasoning behind your recommendations. Well, let's get started!

- more interesting ones:

- ML2014, ML2013: **optical character recognition**
- ML2012: **ad click prediction** (derived from KDDCup 2012)
- DSA2014, DSA2012: **email searcher**
- DSA2013, DSA2011: **spell checker**

—often okay to **reuse with modifications**

My Design: Team Size

- most ideal team size IMHO is 3:
 - **collaborative, dispute resolution, fewer free riders**, etc.
 - but can also allow 4 **if class size too big** for the TAs to grade
- usually allow ≤ 3 :
 - so students do not have the burden to find **exactly 3**
 - students can **flexibly break teams** if needed
 - but **evaluate with workloads of 3** for fairness
- still sometimes hard for some students to find team members:
 - motto: provide matching mechanism, but **not force anyone to any team**
- prevent free riders: need **workload distribution** in report

My Design: Scoreboard

Evaluation	Rank	Team	Public Score	Description	Entries	Time
Timeline	1	Hsinfu	0.067417	Happy New Year~	6	2014-12-31 03:34:42
Submission	2	萬能的大神請保佑我	0.076099		67	2015-01-04 17:19:43
Scoreboard	3	SIMPLE	0.086137	(▽)>	66	2015-01-04 10:18:23
	4	我是暴民拍拍肩膀好棒棒<3	0.091834	ㄏㄏ (▽▽) ㄏㄏ	8	2015-01-02 19:33:03
	5	1+2+3+...=1/12	0.093733	I Never Said I Was Deep - Jarvis Cocker	44	2015-01-01 20:32:08
	6	TA	0.110147	_(_ 「ε」)_ TA Normal Baseline	4	2014-12-16 23:59:57
	7	台大創傷醫學部主任	0.118828	(^口^)~倍返しだ!	26	2015-01-04 20:17:19
	8	神算子	0.128188	Happy 1/1	45	2015-01-01 22:07:38

- core place that makes the game **exciting**
- thanks to my TAs** in all those years for creating and maintaining the service
- basically, a simple **submit-judge-scoreboard** system
- usually provide the students an additional **description** field to interact—though few use it for serious purposes

My Design: Team Names

- good (humorous) team names **make the competition interesting**
 - 我是暴民拍拍肩膀好棒棒<3
 - 耕者有軒田
 - DSAGG(Don't Submit A Goddamn Garbage)
 - DSA ≠ SAD
 - HTLIN (Have To Learn In NTU)
 - “bad” team names?
 - 2014 ITSA 線上程式競賽：「閉上眼睛深吸氣，想想妹妹就打出來囉」
- don't know whether I should “educate” students about this, but up to now **no students crossed my line yet**

My Design: Award Ceremony

- purpose: to **add more fun**
- **light presents** (postcards, paper notebooks, etc.)
- some students list their **good-performing awards in resume**
- may serve some **educational purposes**
- in addition to good-performing awards, can also give **interesting awards**

ML2012: How Much Overfitting Can We Get?

9472 submissions from 52 teams within 1.5 months.....

Award 1: First Submission Award

team	scoreboard	hidden	algorithm	time
Not Here~ Combo Three!!!	0.5018	0.4998	Random	2012/11/27 20:28:38

Award 4: Happy 2013 Award

team	scoreboard	hidden	algorithm	time
Minimaxizer	0.7632	0.7407	rwa	2013/01/01 00:00:08

Award 5: Goodbye 2012 Award

team	scoreboard	hidden	algorithm	time
anything	0.7704	0.7527	b	2012/12/31 23:59:24

Award 7-8: Hard Working Awards

team	submission count
A	1097
anything	1149

My Design: Grade

- generally based on **report**, not competition, but **correlated**
 - too much emphasis on competition \Rightarrow utilitarianism
 - too little emphasis on competition \Rightarrow less interesting game
- ask TAs to act as “bosses”: The grading TAs would grade qualitatively with letters: A++[210], A+[196], A[186], B+[176], B[166], C+[156], C[146], D+[136], D[126], F+[116], F[76], F-[36], Z[0]
- list **basic requirements** corresponding to **B**
 - to get B, students only need to work \approx usual homeworks
 - to get more, need more to convince the TAs
- generally **“loose” about basic requirements**
 - most students perform way beyond the basic requirements anyway
- generally team grade, but **adjust individual grade if workload unbalanced**

My Design: Loading

- ideal: a bit **harder than homework**
- estimate: 60 to 90 man-hours to finish basic requirements (**30 man-hour per member**)
- sometimes need to **adjust loading of other homeworks**
 - not an easy task, though

My Design: Coverage

- motto: try **not restricting** the tools that students use
- but sometimes needing some restrictions in competition for **fairness** and **focus** of project
 - parallel programming for freshmen?
 - external data for optical character recognition?
- decision criterion: which makes **most people in the game** most excited?
- try being **super-flexible in report** to still reward creativity

My Design: TAs

- good TAs' help **essential—I cannot thank them enough!**
- **design, system setup, discuss with students**
- unfortunately, NTU **cannot pay many TAs**
—many of our TAs are **volunteers**
(joined under **total free will**, even for my lab students)

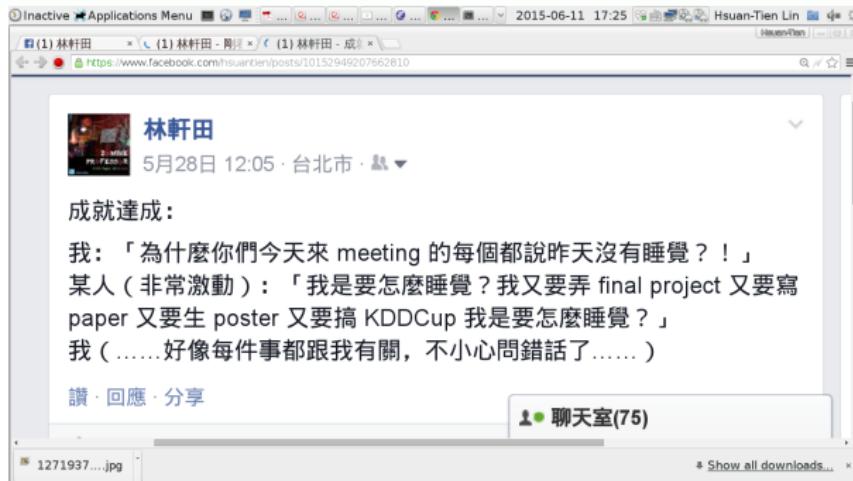


- some TAs even **play in competition** (good or bad)

Rank	Team	Public Score	Description	Entries	Time
1	TA	0.220700	TA Simple Baseline _((3, 4))_	2	2014-12-01 12:00:41
2	Emily	0.282556	LIBLINEAR, people's best friend!	3	2014-12-04 17:48:16

My Design: TAs

always note: TAs are **busy**!!



My Design: Instructor

my main job: **heat up the competition**

Inactive Applications Menu 2015-06-11 17:26 Hsuan-Tien Lin

(1) 林軒田 (1) 林軒田 - 剛剛 (1) 林軒田 - 成績 (1) 林軒田 - 經過

<https://www.facebook.com/hsuantien/posts/10152190101527810>

搜尋人、地點和事物

林軒田
2014年6月2日 · 台北市 ·

經過一天的努力，DSA Final Project Winner 把程式弄快了十倍？！

1 GingaPasokonKohjinsha 150772 10.000000 2014-06-02
01:10:48

粽子節快樂！ 😊

main.learner.csie.ntu.edu.tw/.../dsa14.../scoreboardeachteam.php

ScoreBoard
MAIN.LEARNER.CSIE.NTU.EDU.TW

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Wan-Yu Lin、陳美惠、林子翔以及其他 19 人都說讚。

Deep Link 這頁面是自動從 A 署錄到 B 署錄的

1271937.jpg

來自 Shiten Huang 和 張宇航的 1 则通知

アラランス Advera 初回活動限定

愛德蘭絲 頭皮清潔養髮體驗實施
aderanstaiwan.com.tw
這是您頭髮改變重生的機會！您想看看愛德蘭絲的頭皮清潔養髮體驗價需要2,500元—現在只要1,000元公開中！還在為頭髮煩惱中嗎？

聊天室(74)

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My Design: Instructor

my main job: **heat up the competition**

Inactive Applications Menu

2015-06-11 17:29

Hsuan-Tien Lin

<https://www.facebook.com/hsuantien/posts/136955389793443>

林軒田 搜尋人、地點和事物

林軒田 首頁 4

林軒田 2012年12月23日 · 點

Machine Learning Final Project 戰況激烈，前八名都已經突破了0.76，哪一隊能再往前衝呢？

1 anything 0.7669121652 2012/12/22 22:38:22
2 E_out = 1 0.7637004382 2012/12/22 05:46:59
3 Not Here~ Combo Three!!! 0.7634856921 2012/12/22 20:51:35
4 Cd3qw3sCN5 0.7628418524 2012/12/21 21:21:57
5 Let's ML 0.7623863265 2012/12/20 23:34:53

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1271937....jpg

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PLACEPOCKET 蔽集你的口袋名單

把想去的地方存起來
signup.placeocket.com
上次那個地方叫什麼名字？你的這裡。

聊天室(71)

My Design: Instructor

my main job: **heat up the competition**

Inactive Applications Menu 2015-06-11 17:24 Hsuan-Tien Lin

(1) 林軒田 - 剛剛 (1) 林軒田 - 成功 https://www.facebook.com/hsuantien/posts/10152976986292810

事物

林軒田 🤯 覺得震驚
6月7日 22:34 · 台北市 · 人 ·

剛看了一下 final project submission site, 還有兩週截止, 可是居然沒有隊伍在計分板上露臉.....

看來今年 DSA 全當掉應該不是開玩笑的

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聊天室(76)

1271937....jpg Show all downloads...

My Design: Instructor

my two other jobs:

- participate **seriously in the design**
- maintain **fairness** of competition

Less Successful Stories

- DSA2015: **announced late, hard homework**
- DSA2011: **decide to do final project too late**
- ML2013: **task too easy in some sense**

Some Summary Thoughts

Positive Side

- **fun** for most students, TAs and instructor
- students, TAs and instructor **learn a lot**

Negative Side

- **exhausting** for most students, TAs and instructor
- **can be disappointing** for some students

Questions and Discussions?