疫情后新常态下的
在线教育发展前景

教育部在线教育研究中心副主任
教育部教学信息化与教学方法创新指导委员会副主任委员
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孙茂松

2020年12月11日

一、在线教学：线下搬到线上？

- 至4月4日，全球188个国家全国停课，约15.76亿学生无法继续学业，占注册学生总数91.3%，受影响的占注册学生总数99.4%
- 疫情期间，我国在线教学实践取得显著成效。据教育部数据，截至4月3日，全国在线开学的普通高校共计1454所，开设在线课程713.3万门次，参加在线课程学习的学生达11.8亿人次
- 此次大规模在线教学实践是世界高等教育史上的首次探索，也是全球范围内的重要实验。现代信息技术全面进入教与学过程，改变了"教"与"学"的方式，丰富了教育的形态

713.3万 门次

95万余名教师开设94.2万门、713.3万门次在线课程

学堂在线　首页　全部课程　计算机学院　职场商学　更多 ∨　　搜索课程/院校名称　　　　登录　注册

清华大学 Tsinghua University　　北京大学 PEKING UNIVERSITY　　北京师范大学 BEIJING NORMAL UNIVERSITY　　国防科技大学 National University of Defense Technology　　MIT Massachusetts Institute of Technology　　Санкт-Петербургский государственный университет

热门直播

04月15日 14:00 开播	04月15日 19:30 开播	04月15日 19:30 开播	04月16日 19:00 开播
不确定性时代的计算传播学研究	软件定义新基建 数据驱动新未来	针对新型冠状病毒的药物研发	瘟疫之年：重新认识牛顿

一、在线教学：线下搬到线上？

- 两大类平台
- 他山之石：腾讯会议、钉钉、ZOOM……
- 雨课堂（基于实际教学需求，以学生为中心）

  + 基于PPT和微信，不用安装额外的APP

  + 习题直接在PPT里进行编辑，随时可测验

  + 测试即时结果统计

  + 利用课前课件功能推送案例，案例里配上自己的语音和主观的思考题
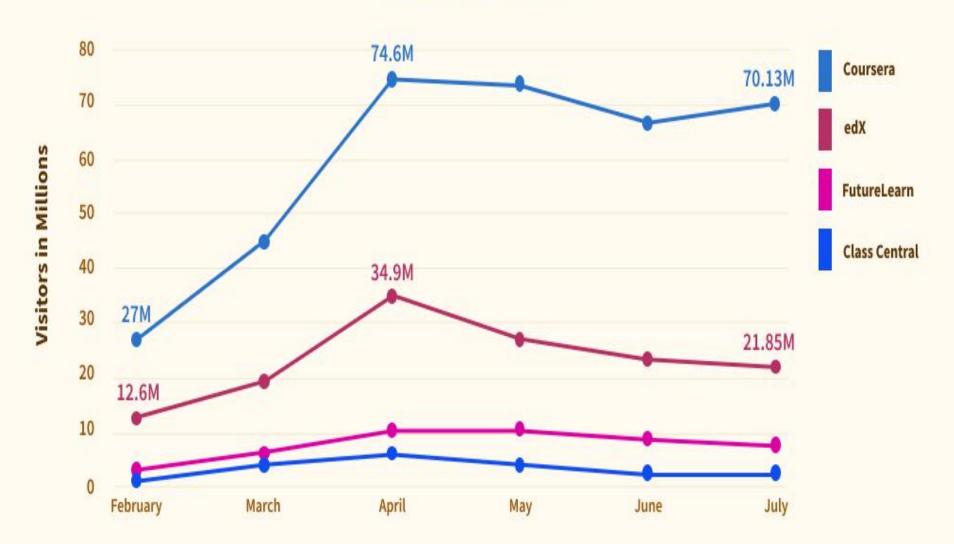
  + 利用分组功能进行小组讨论，形成结果，再利用投稿功能进行点评

  + 弹幕 ……

二、不忘慕课"初心"

Free Courses about COVID-19

As coronavirus spread, universities started launching free online courses about the pandemic. You can find the full course list here and a selection of courses below.

- **Harvard**: Mechanical Ventilation for COVID-19
- **Stanford**: CS472 Data science and AI for COVID-19
- **Imperial**: Science Matters: Let's Talk About COVID-19
- **Johns Hopkins**: Fighting COVID-19 with Epidemiology
- **Toronto**: Mind Control: Managing Your Mental Health During COVID-19

2020 Web Traffic

Visitors in Millions

Coursera: 27M (February), 74.6M (April), 70.13M (July)

edX: 12.6M (February), 34.9M (April), 21.85M (July)

Legend:
- Coursera
- edX
- FutureLearn
- Class Central

X-axis: February, March, April, May, June, July

Source: SimilarWeb

New Registered Users	2019	2020	Total
coursera	8M	20M	65M
edX	5M	8M	32M
Future Learn	1.3M	4M	13.5M
CLASS CENTRAL	350k	700k	2.2M

Increased demand to learn on Coursera

Coursera new user enrollments

Since mid-March...

35 million total enrollments

16 million new registered learners

	April 30th Rank[1]	Sessions (in millions)[2]
Coursera	#287 (+157)	45 (↑67%)
edX	#663 (+510)	19.2 (↑52%)
FutureLearn	#3,009 (+3189)	6.15 (↑116%)
Class Central	#4,693 (+12,488)	4.4 (↑406%)

1. Based on Alexa Ranking. Numbers in parentheses point to the change in ranking since March 14th.
2. Number of sessions in March and percent change from February. Based on SimilarWeb data.

■ 优质课程共享是慕课的核心理念和元素
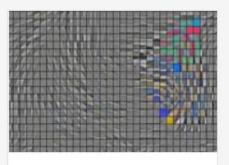
Neural Networks for Machine Learning

Neural
Networks for
Machine
Learning

Starts 11月 28

助学金仅对无法承担费用的学生提供。
了解更多并申请。

关于此课程： Learn about artificial neural networks and how they're being used for machine learning, as applied to speech and object recognition, image segmentation, modeling language and human motion, etc. We'll emphasize both the basic algorithms and the practical tricks needed to get them to work well.

∨ 更多

制作方： 多伦多大学

UNIVERSITY OF
TORONTO

教学方： Geoffrey Hinton, Professor

Department of Computer Science

ACM Announces 2018 Turing Award Recipients

ACM has named Yoshua Bengio, Geoffrey Hinton, and Yann LeCun recipients of the 2018 ACM A.M. Turing Award for conceptual and engineering breakthroughs that have made deep neural networks a critical component of computing.

Working independently and together, Hinton, LeCun and Bengio developed conceptual

Yoshua Bengio   Geoffrey Hinton   Yann LeCun

2020-12-15

Yale

金融市场

An overview of the ideas, methods, and institutions that permit human society to manage risks and foster enterprise.
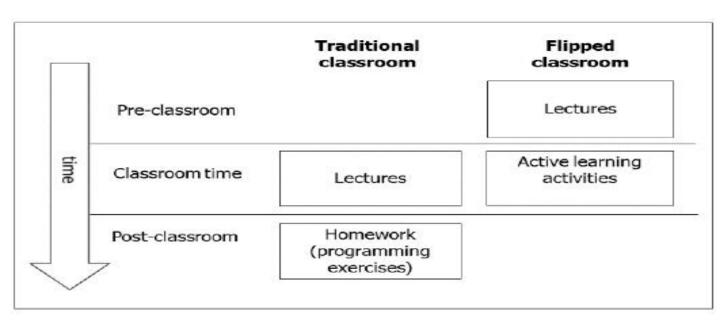

Robert Shiller

Sterling Professor of Economics at Yale University
Economics
Yale University

Robert J. Shiller is Sterling Professor of Economics, Department of Economics and Cowles Foundation for Research in Economics, Yale University, and Professor of Finance and Fellow at the International Center for Finance, Yale School of Management. He received his B.A. from the University of Michigan in 1967 and his Ph.D. in economics from the Massachusetts Institute of Technology in 1972. He has written on financial markets, financial innovation, behavioral economics, macroeconomics, real estate, statistical methods, and on public attitudes, opinions, and moral judgments regarding markets.

Bob was awarded the 2013 Nobel Prize in Economic Sciences for his "empirical analysis of asset prices."

■问题：优质课程推广使用不够

翻转课堂、混合教学？

Evaluation of Evidence-Based Practices in Online Learning
A Meta-Analysis and Review of Online Learning Studies

Revised September 2010

- Purely Online Versus Face-to-Face (Category 1)

- Blended Versus Face-to-Face (Category 2)

Exhibit 4a. Purely Online Versus Face-to-Face (Category 1) Studies Included in the Meta-Analysis

finding

Title	Effect Size		95-Percent Confidence Interval		Test of Null Hypothesis (2-tail)	Retention Rate (percentage)		Number of Units Assigned[a]
	g	SE	Lower Limit	Upper Limit	Z-Value	Online	Face-to-Face	
Pressure ulcers: E-learning to improve classification by nurses and nursing students	+0.294	0.097	0.104	0.484	3.03**	Unknown	Unknown	426 participants
Online vs. live methods for teaching difficult airway management to anesthesiology residents	+0.278	0.265	-0.241	0.797	1.05	100	100	56 participants
A randomized controlled trial comparing Web to in-person training for child care health consultants	+0.046	0.340	-0.620	0.713	0.14	Unknown	Unknown	23 participants
Evaluation of a particle repositioning maneuver Web-based teaching module	+0.790	0.493	-0.176	1.756	1.60	Unknown	Unknown	17–20 participants[b]
A comparative study of traditional, Web-based and online instructional modalities in a computer programming course	+0.132	0.310	-0.476	0.740	0.43	100	100	60 students
Assessing the success rate of students using a learning management system together with a collaborative tool in Web-based teaching of programming languages	+0.466	0.335	-0.190	1.122	1.39	Unknown	Unknown	54 students
Developing online courses: A comparison of Web-based instruction with traditional instruction	-0.379	0.339	-1.042	0.285	-1.12	Unknown	Unknown	2 courses/ classrooms
Employees' attitudes toward e-learning: Implications for policy in industry environments	+0.028	0.155	-0.275	0.331	0.18	70	58.33	168 participants
Educating generalist physicians about chronic								

Key findings：

- Students in online conditions performed modestly better, on average, than those learning same material through traditional face-to-face instruction.

- Instruction combining online and face-to-face elements had a larger advantage relative to purely face-to-face instruction than did purely online instruction.

- The effectiveness of online learning approaches appears quite broad across different content and learner types.

- Online learning can be enhanced by giving learners control of their interactions with media and prompting learner reflection.

- Providing guidance for learning for groups of students appears less successful than does using such mechanisms with individual learners.

Active learning increases student performance in science, engineering, and mathematics
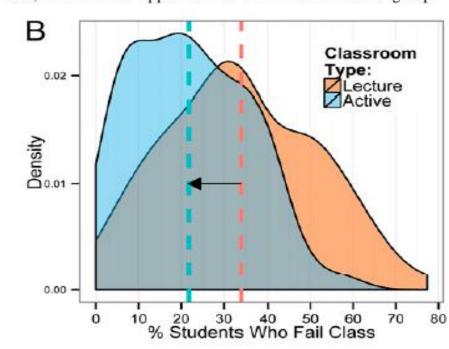
Scott Freeman[a,1], Sarah L. Eddy[a], Miles McDonough[a], Michelle K. Smith[b], Nnadozie Okoroafor[a], Hannah Jordt[a], and Mary Pat Wenderoth[a]

[a]Department of Biology, University of Washington, Seattle, WA 98195; and [b]School of Biology and Ecology, University of Maine, Orono, ME 04469

To test the hypothesis that lecturing maximizes learning and course performance, we metaanalyzed 225 studies that reported data on examination scores or failure rates when comparing student 225 studies in the published and unpublished literature. The active learning interventions varied widely in intensity and implementation, and included approaches as diverse as occasional group

- Undergraduate STEM: These result

■indicate that average examination

■scores improved by about 6% in active learning sections, and that students in classes with traditional lecturing were

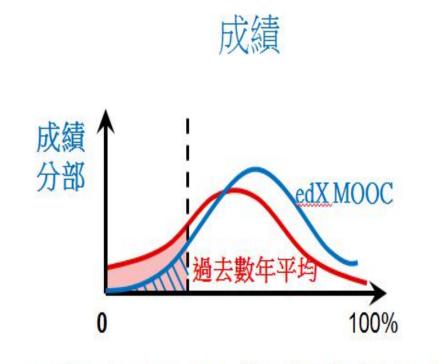■1.5 times more likely to fail than were students in classes with active

MOOC（SPOC）的教学效果

■ San Jose State University:

SJSU与edX 合作關係與成果

- 2012年七月三位SJSU教授在edX受訓訪問一星期
- 2012年秋季起SJSU用edX教材6.002x教 線路分析(Circuit Analysis)(大二)
- 用翻转课堂方式上課

成績

成績分部

edX MOOC

過去數年平均

0   100%

C 或C以上百分比 從65% 進步到91%

引自圣何塞加州州立大学许平教授PPT

MOOC（SPOC）的教学效果

Software Engineering Curriculum Technology
Transfer: Lessons learned from MOOCs and SPOCs

Armando Fox
David A. Patterson
Richard Ilson
Samuel Joseph
Kristen Walcott-Justice
Rose Williams

Electrical Engineering and Computer Sciences
University of California at Berkeley

Technical Report No. UCB/EECS-2014-17
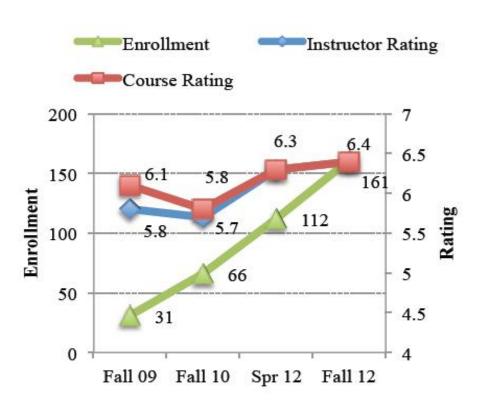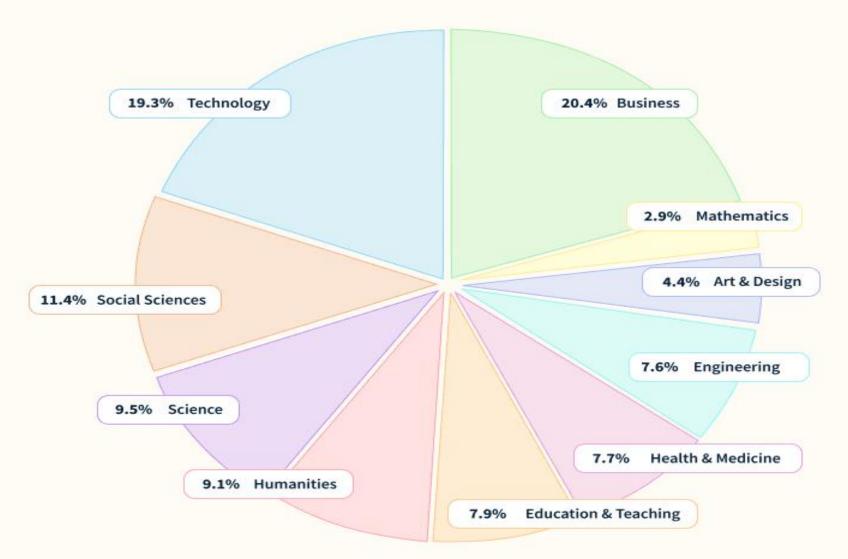http://www.eecs.berkeley.edu/Pubs/TechRpts/2014/EECS-2014-17.html

March 5, 2014

Figure 1. Course enrollment and instructor and course ratings of CS 169 Software Engineering. Course growth continues; Fall 2013 has 240 students. The first two offerings are without the SPOC and the last two are with the SPOC (see Section 4).

Course Distribution by Subject

- 19.3% Technology
- 20.4% Business
- 2.9% Mathematics
- 4.4% Art & Design
- 11.4% Social Sciences
- 7.6% Engineering
- 9.5% Science
- 7.7% Health & Medicine
- 9.1% Humanities
- 7.9% Education & Teaching

THE CHRONICLE OF HIGHER EDUCATION

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Wired Campus
The latest on tech and education.

March 10, 2015 by Steve Kolowich   Comments (12)

Yale Announces 'Blended' Online Master's Degree

Yale University is creating a master's program that will hold many courses online, continuing the Ivy League institution's foray into "blended" learning.

- 此项目将取代目前该校的线下医生助理培训项目
- 该项目的线下实习部分，学习者可以到耶鲁批准的其居住地附近诊所进行
- 该项目预期入学人数可以从40增加到300

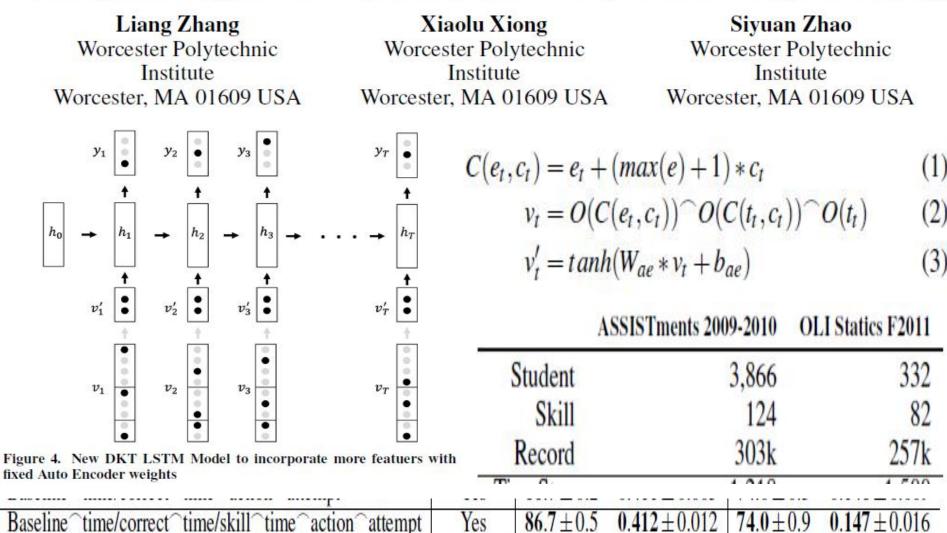# The London Festival of Learning

Conferences

- The 19th International Conference on Artificial Intelligence in Education
- The 5th Annual ACM Conference on Learning at Scale
- The 13th International Conference of the Learning Sciences

  Theme: Rethinking learning in the digital age: making the Learning Sciences count

通过学习行为日志对学习者建模

Incorporating Rich Features into Deep Knowledge Tracing

Liang Zhang
Worcester Polytechnic
Institute
Worcester, MA 01609 USA

Xiaolu Xiong
Worcester Polytechnic
Institute
Worcester, MA 01609 USA

Siyuan Zhao
Worcester Polytechnic
Institute
Worcester, MA 01609 USA

Figure 4. New DKT LSTM Model to incorporate more featuers with fixed Auto Encoder weights

$$C(e_t, c_t) = e_t + (max(e) + 1) * c_t \qquad (1)$$

$$v_t = O(C(e_t, c_t))^\frown O(C(t_t, c_t))^\frown O(t_t) \qquad (2)$$

$$v'_t = tanh(W_{ae} * v_t + b_{ae}) \qquad (3)$$

	ASSISTments 2009-2010	OLI Statics F2011
Student	3,866	332
Skill	124	82
Record	303k	257k

		ASSISTments 2009-2010		OLI Statics F2011	
Baseline^time/correct^time/skill^time^action^attempt	Yes	86.7 ± 0.5	0.412 ± 0.012	74.0 ± 0.9	0.147 ± 0.016

Table 2. Test Result

通过学习行为日志和课程内容对课程建模

A Probabilistic Approach for Discovering Difficult Course Topics Using Clickstream Data

Assma Boughoula
201 N Goodwin Ave
Urbana, IL 61801

Chase Geigle
201 N Goodwin Ave
Urbana, IL 61801

ChengXiang Zhai
201 N Goodwin Ave
Urbana, IL 61801

The log-likelihood function is then

$$\log p(D \mid \Pi, \Theta) =$$

$$\sum_{i=1}^{N} \log \left(\sum_{k=1}^{K} p(z_i = k \mid \pi_i) \times \prod_{j=1}^{\|d_i\|} p(d_{i,j} \mid \theta_k \right.$$

which is maximized via the use of the EM algorithm

$$p(\delta_k = 1 \mid k, H) \approx \frac{\sum_{i=1}^{N} H_i \times \pi_{i,k}}{\sqrt{\sum_{i=1}^{N} H_i^2} \times \sqrt{\sum_{i=1}^{N} \pi_{i,k}^2}}$$

$$VID = 0.636$$

Topic	P(Diff=1| Topic,H)
0	0.0595
1	0.0583
2	0.0576
3	0.0564
4	0.0506
12	0.0469
6	0.04669
16	0.04667
15	0.04664
11	0.0465
9	0.0463
13	0.0461
8	0.0458
14	0.0456
5	0.0453
10	0.0452
7	0.0437

Table 2. Difficulty Rankings from Video Activity
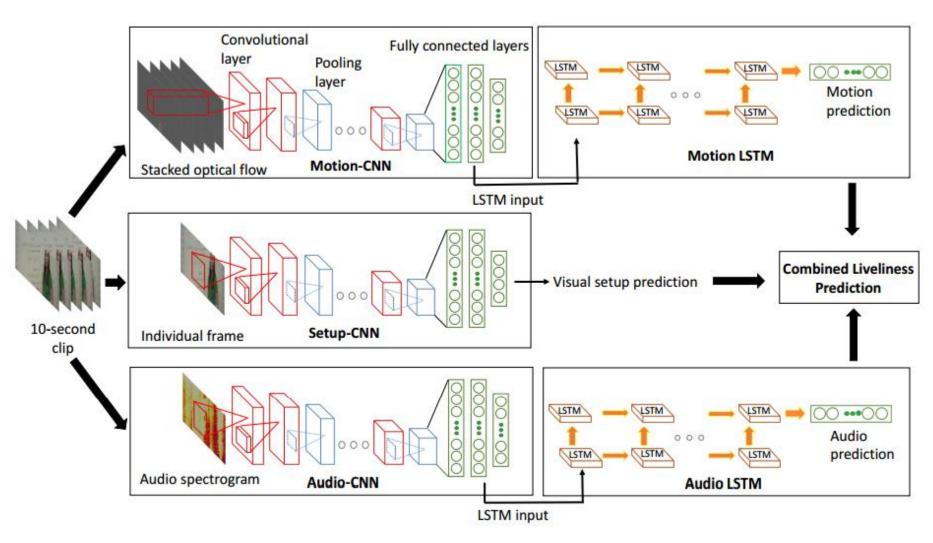
通过视频活跃度自动检测对教师授课形式建模

- **LIVELINET: A Multimodal Deep Recurrent Neural Network to Predict Liveliness in Educational Videos（Xerox Research Centre India，2016）**

- When educational videos are not engaging, students tend to lose interest in the course content.

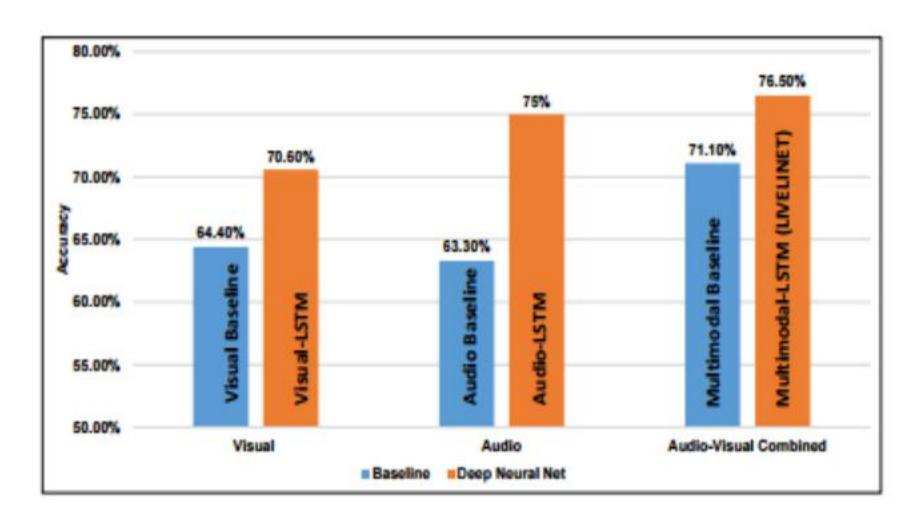- Liveliness is the most influential dimension in making a video engaging.
  - ☐

通过视频活跃度自动检测对教师授课方式建模

通过视频活跃度自动检测对教师授课方式建模

Labels	Example 1	Example 2	Example 3
Content (Only Audio)			
Person Walking/Standing (Audio and Visual both)			
Person Sitting (Audio and Visual both)			
Content & Person (Audio and Visual both)			
Miscellaneous (Only Audio)			

通过视频活跃度自动检测对教师授课方式建模

Jill Watson: Our Newest TA

- Creation of Prof. Ashok Goel

- TA for CS 7637: Knowledge-Based Artificial Intelligence

- Based on IBM Watson platform

- Anticipate that Jill will be able to answer 40% of ~10,000 questions posted to online forum

Ashok Goel

From the 2015 film, Ex Machina

"学堂在线" 小木– 基于人工智能的学伴

➤ 小木机器人是什么

小木机器人是**智能的学习助理**，由学堂在线和清华大学联合研发，**集辅助选课、知识查询、学习问答、学习管理、机器人客服**于一身，可帮助学习者解决在线学习过程中不知道自己适合学习什么、没人辅导、没人监督、孤独等问题；可帮助教师提升教学效果；可提高平台服务质量。

➤ 小木机器人产品功能

功能包括：智能选课、机器人客服、个性化学习计划、智能记忆复习、知识点推荐、自助问答、真人问答、知识点导航、智能提问、游戏化激励、社交引导、学习能力训练与提升等等。
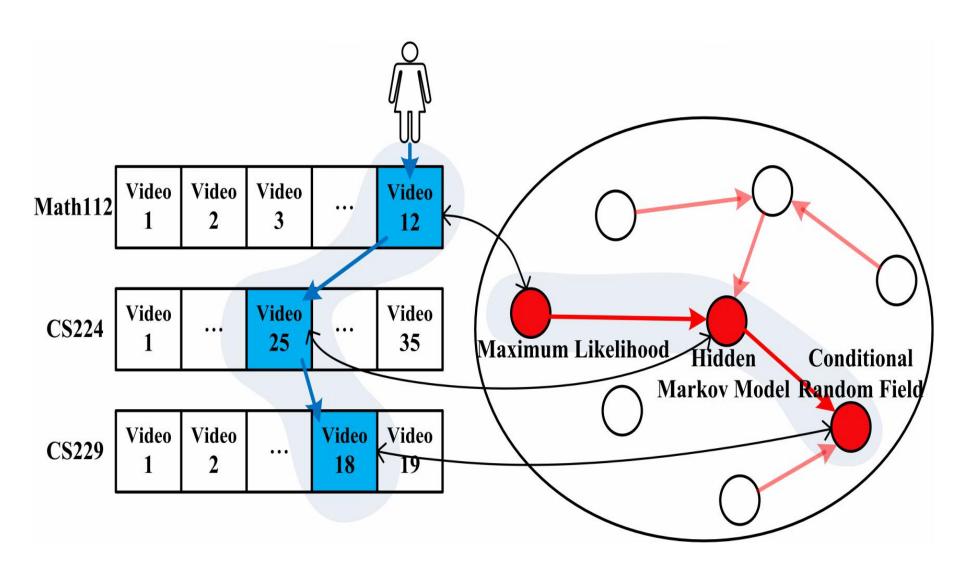
小木-课程知识图谱

小木–知识点相关优秀论文推荐

■ Top-N research paper recommendation for students in terms of any concept(terminology)
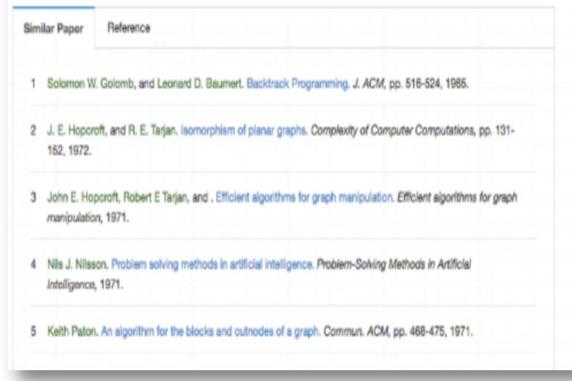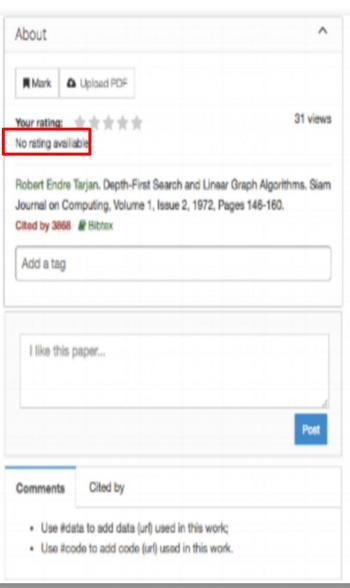
小木–知识点相关优秀论文推荐
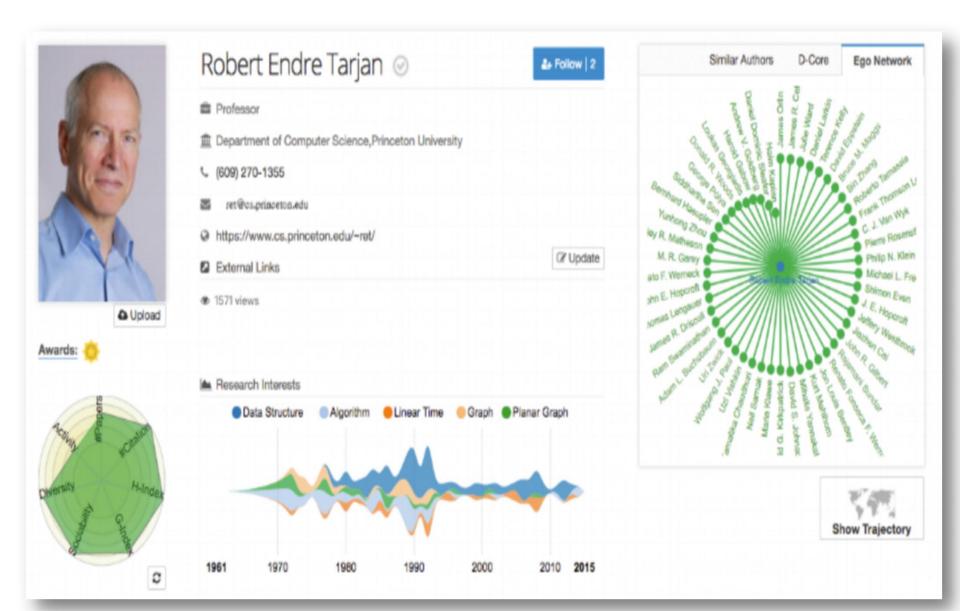
小木–知识点相关优秀论文推荐

面向在线教学的人工智能与大数据研究

- 建立学习社交网络乃至全国性网络学习空间
- 基于教育大数据的机器学习算法
- 大规模课程知识图谱研究及建设，以之为桥梁彻底打通课程之间的关联，并进一步彻底打通课程与数字论文库、数字图书库之间的关联
- 各类课程的智能辅助教学算法（主观题为主）
- 跨语言教育的技术支撑环境
- VR、AR以及虚拟实验室
- 在上述基础上，构建智能助教
- 用于教学的人工智能技术伦理

……

- 全国性学术会议？

习近平总书记向国际人工智能与教育大会致贺信 (2019年5月16日)

中国高度重视人工智能对教育的深刻影响，积极推动人工智能和教育深度融合，促进教育变革创新，充分发挥人工智能优势，加快发展伴随每个人一生的教育、平等面向每个人的教育、适合每个人的教育、更加开放灵活的教育。

中国愿同世界各国一道，聚焦人工智能发展前沿问题，深入探讨人工智能快速发展条件下教育发展创新的思路和举措，凝聚共识、深化合作、扩大共享，携手推动构建人类命运共同体。

谢谢！