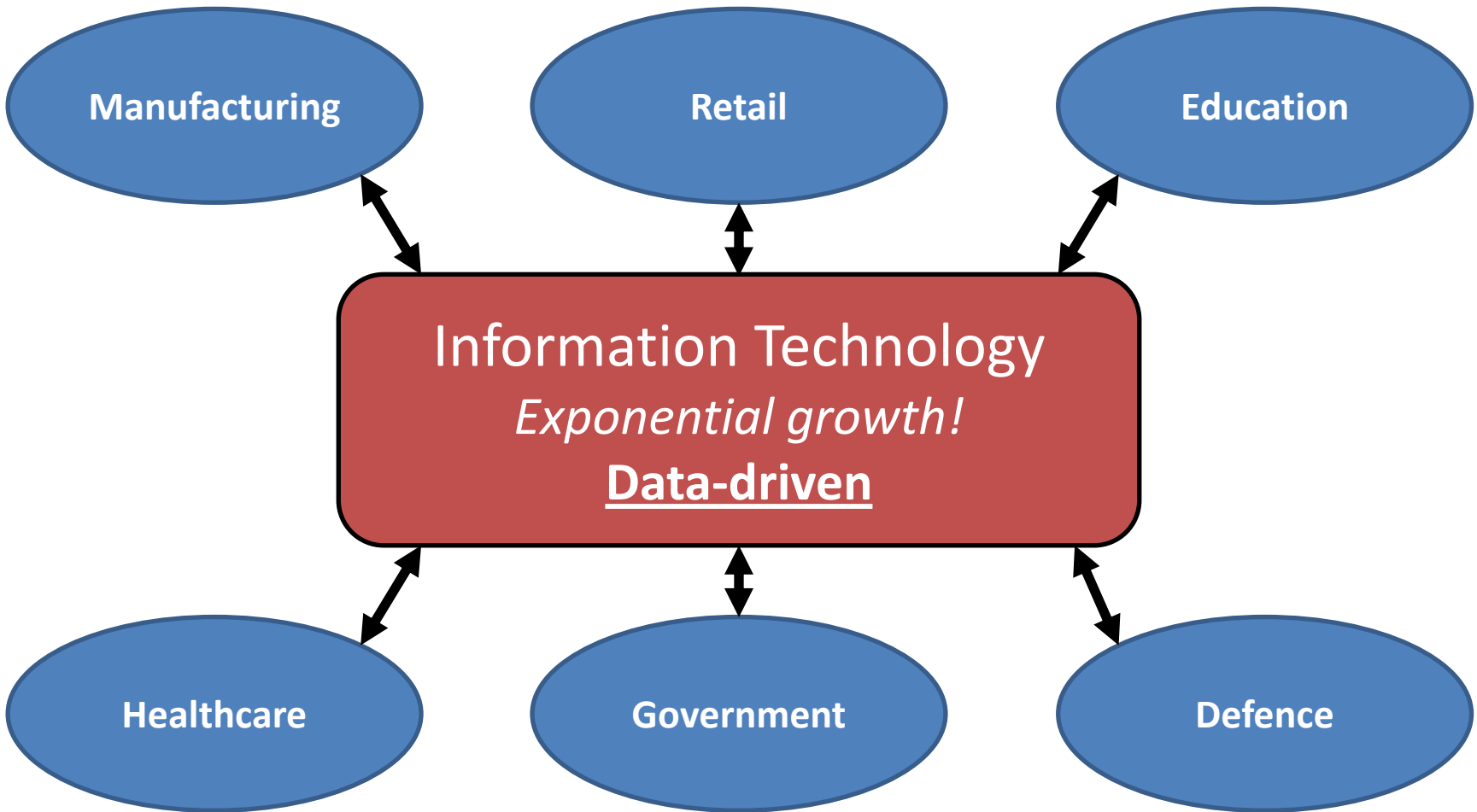


Machine Learning

The Future of Computing?

Chris Bishop

Microsoft Research Cambridge



What can you do with data?

Visualization

Calculate simple statistics

Make predictions (traditional machine learning)

Build models (probabilistic inference)

KINECT™

for  XBOX 360.





KINECT™
for  **XBOX 360**

Microsoft
Research



Machin
for Kin
Motion

Kinect for
the contro
imaging h
motion ca
software
relies on
combinat
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C



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10 March 2011 Last updated at 06:09 ET



Microsoft Kinect 'fastest-selling device on record'

Microsoft has sold more than 10 million Kinect sensor systems since launch on 4 November, and - according to Guinness World Records - is the fastest-selling consumer electronics device on record.

The sales figures outstrip those of both Apple's iPhone and iPad when launched, Guinness said.

Kinect is an infrared camera add-on for Microsoft's Xbox 360 games console that allows it to track body movements.



The popularity of the Kinect has helped to boost sales of games, Microsoft says

Related Stories

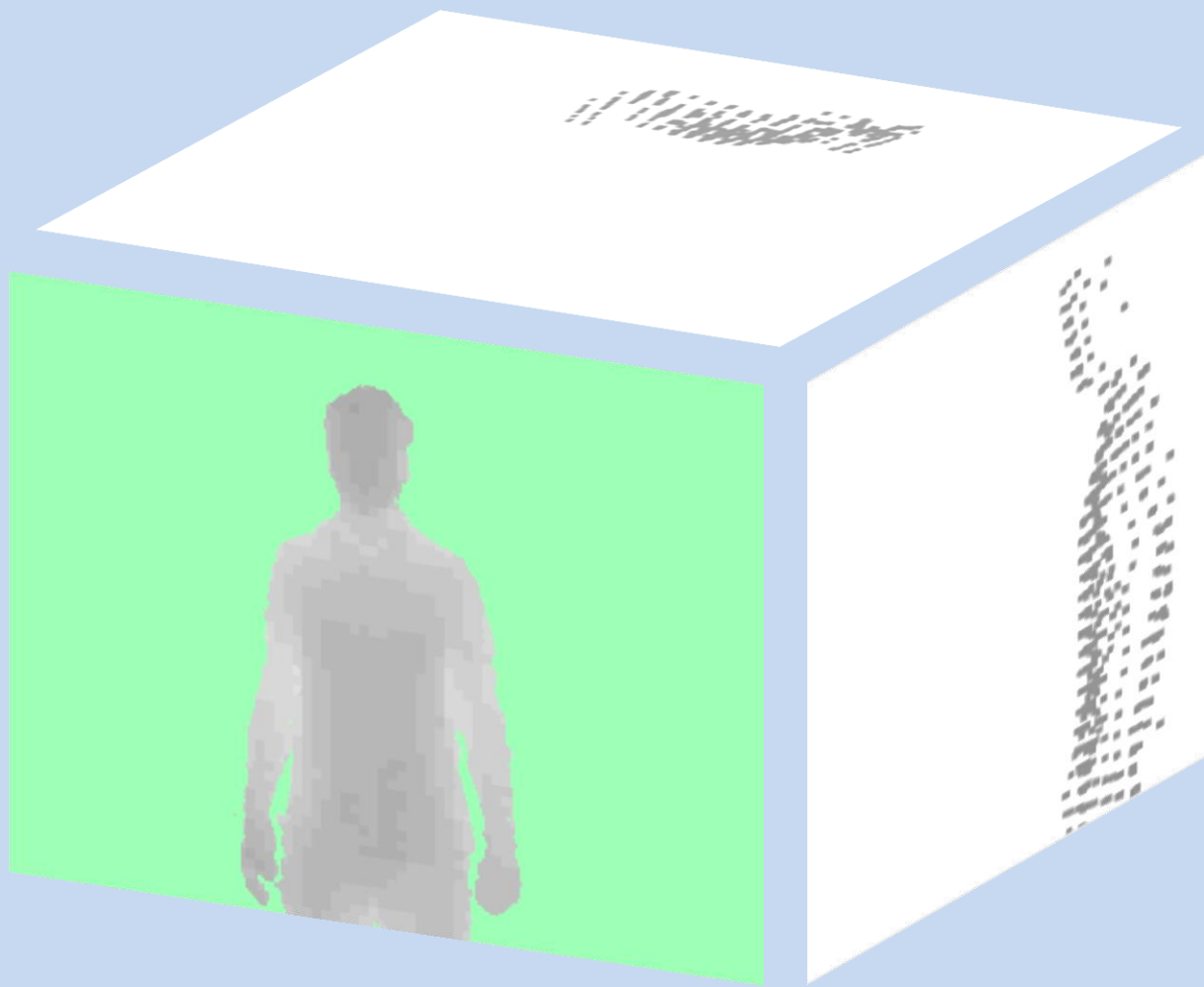
KINECT™

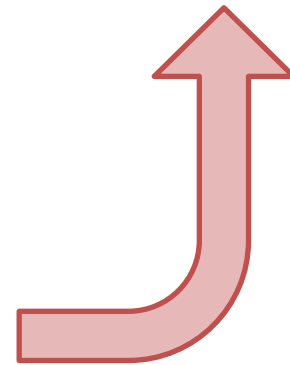
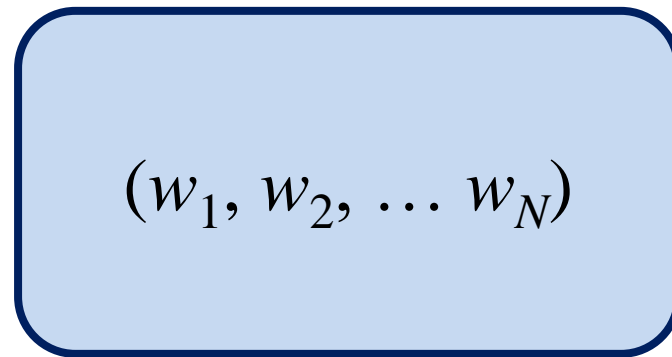
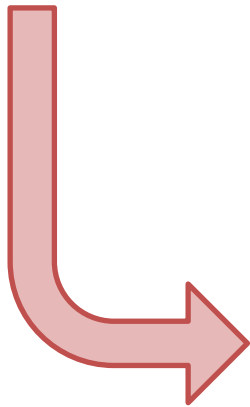
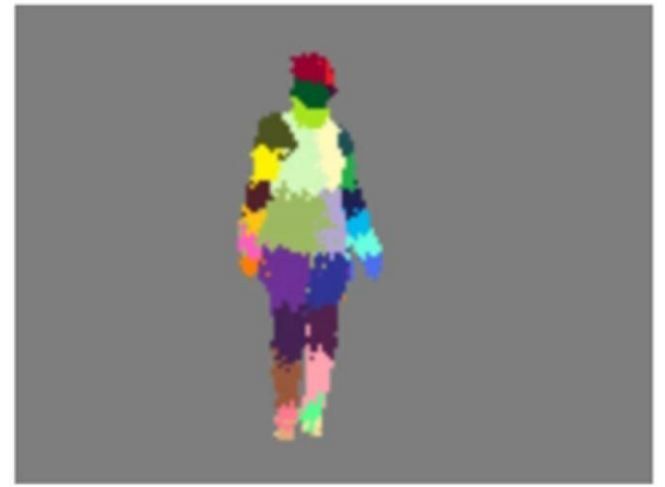
for  XBOX 360.

infra-red
emitter

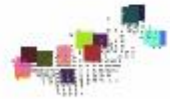
infra-red
camera












Future applications?




Movie Recommender



infer.net



My Games



Browse Games



Search Games



Halo 4





Call of Duty: Black Ops II



FIFA Soccer 13




Nike+ Kinect Training



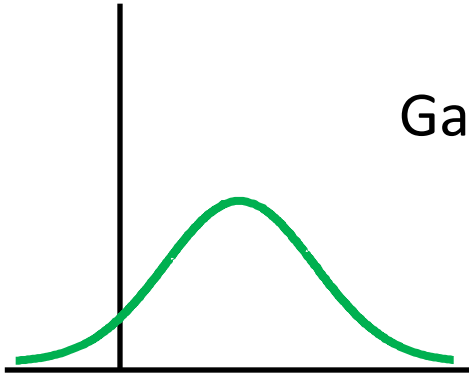
Gears of War: Judgment

Gears of War: Judgment:
Recommended because of Gears of War 3

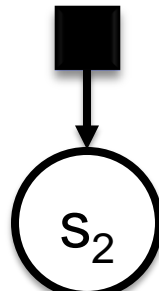
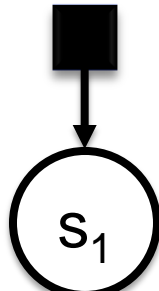


All Recommendations

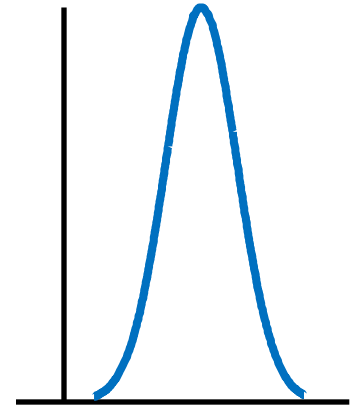




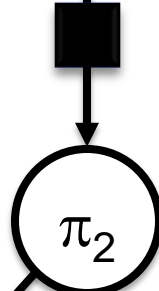
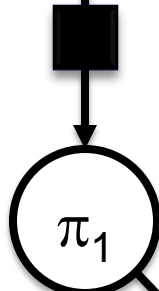
Gaussian



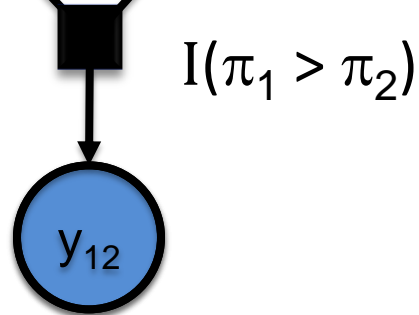
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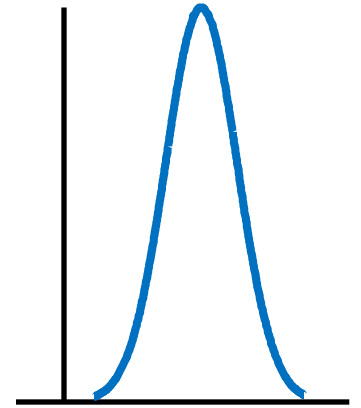
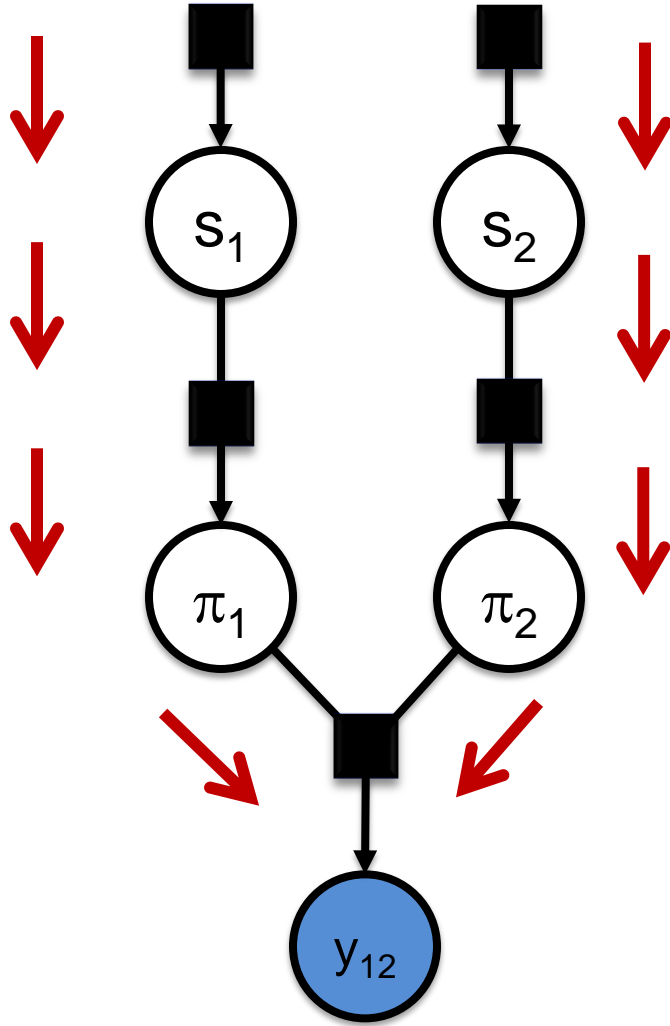
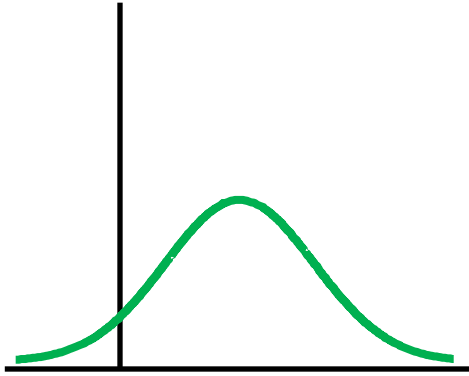


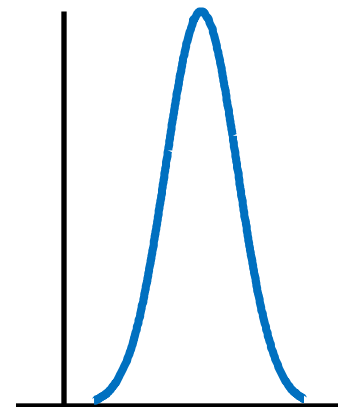
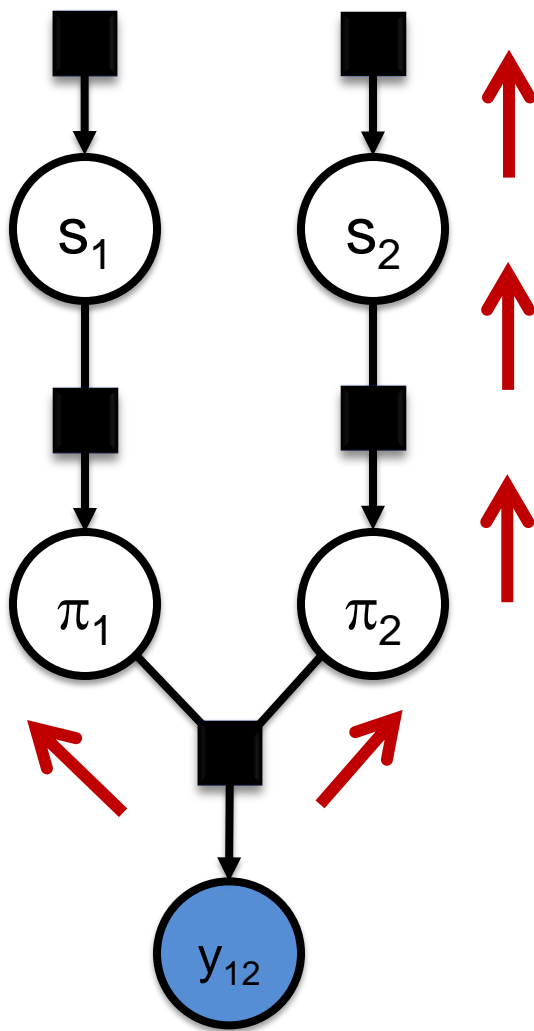
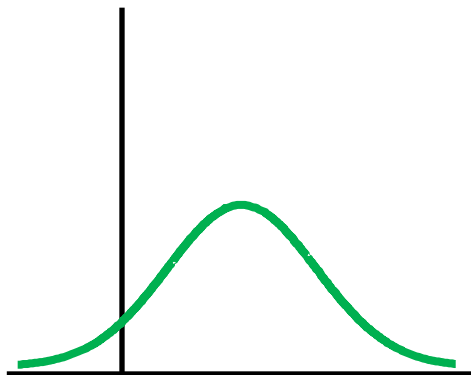
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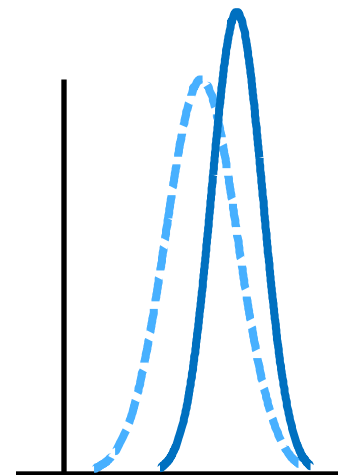
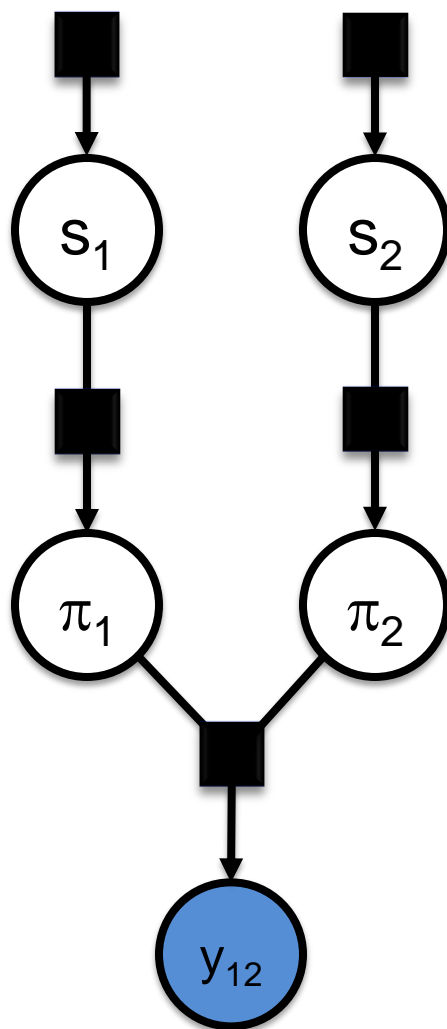
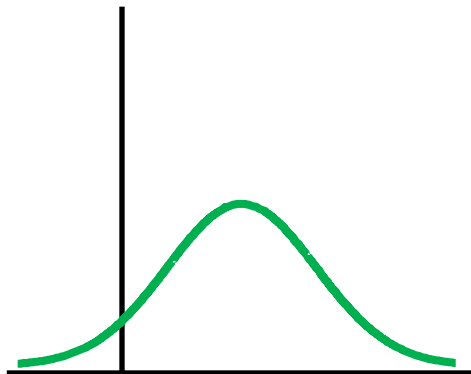


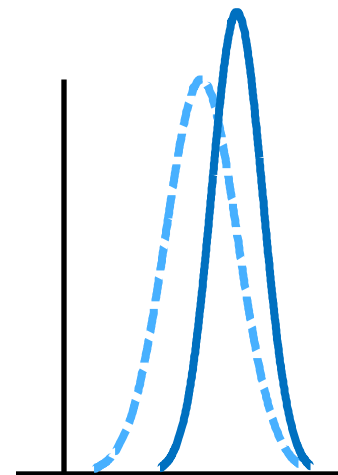
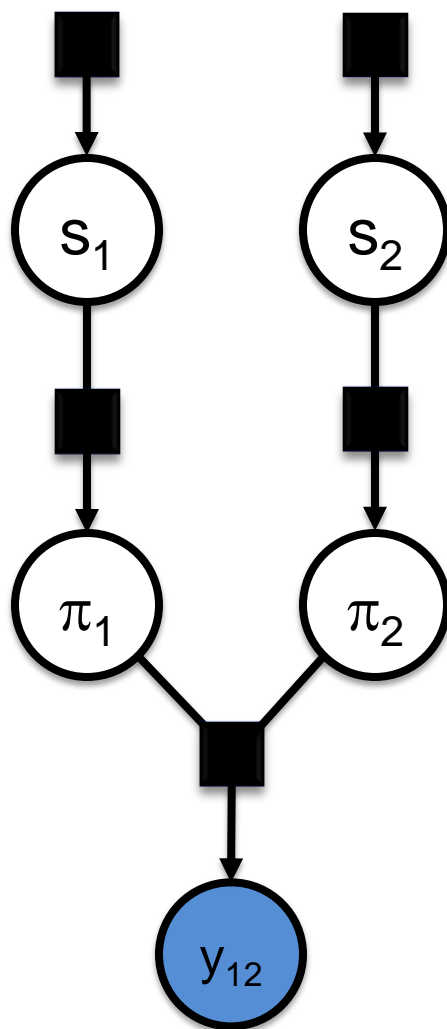
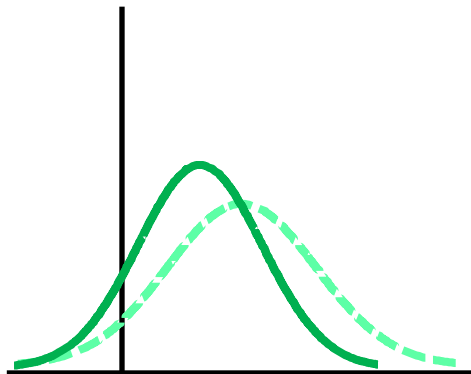
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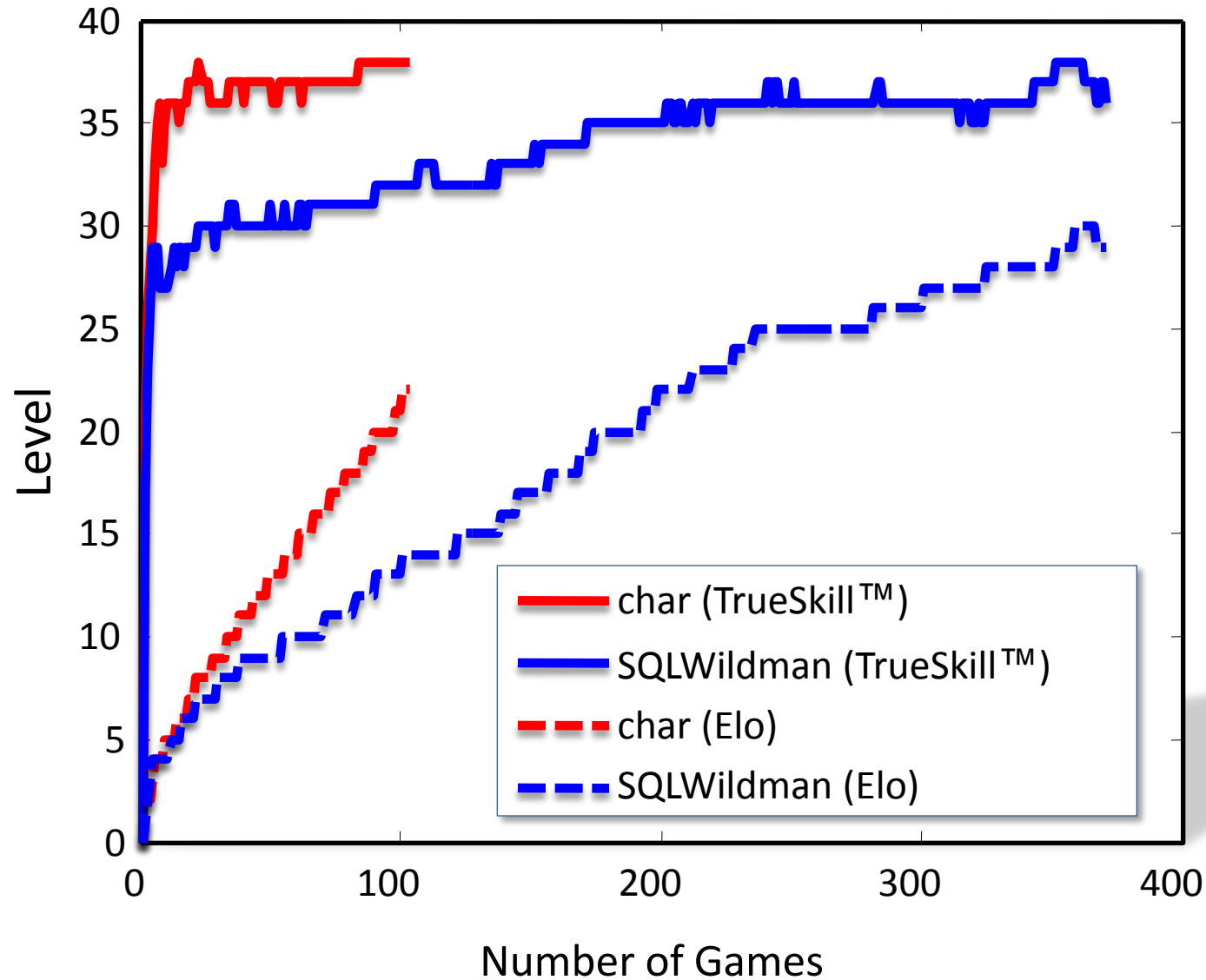








Convergence



TrueSkill™



Sept. 2005,
10s million users,
millions of matches per day

Probabilistic Programming

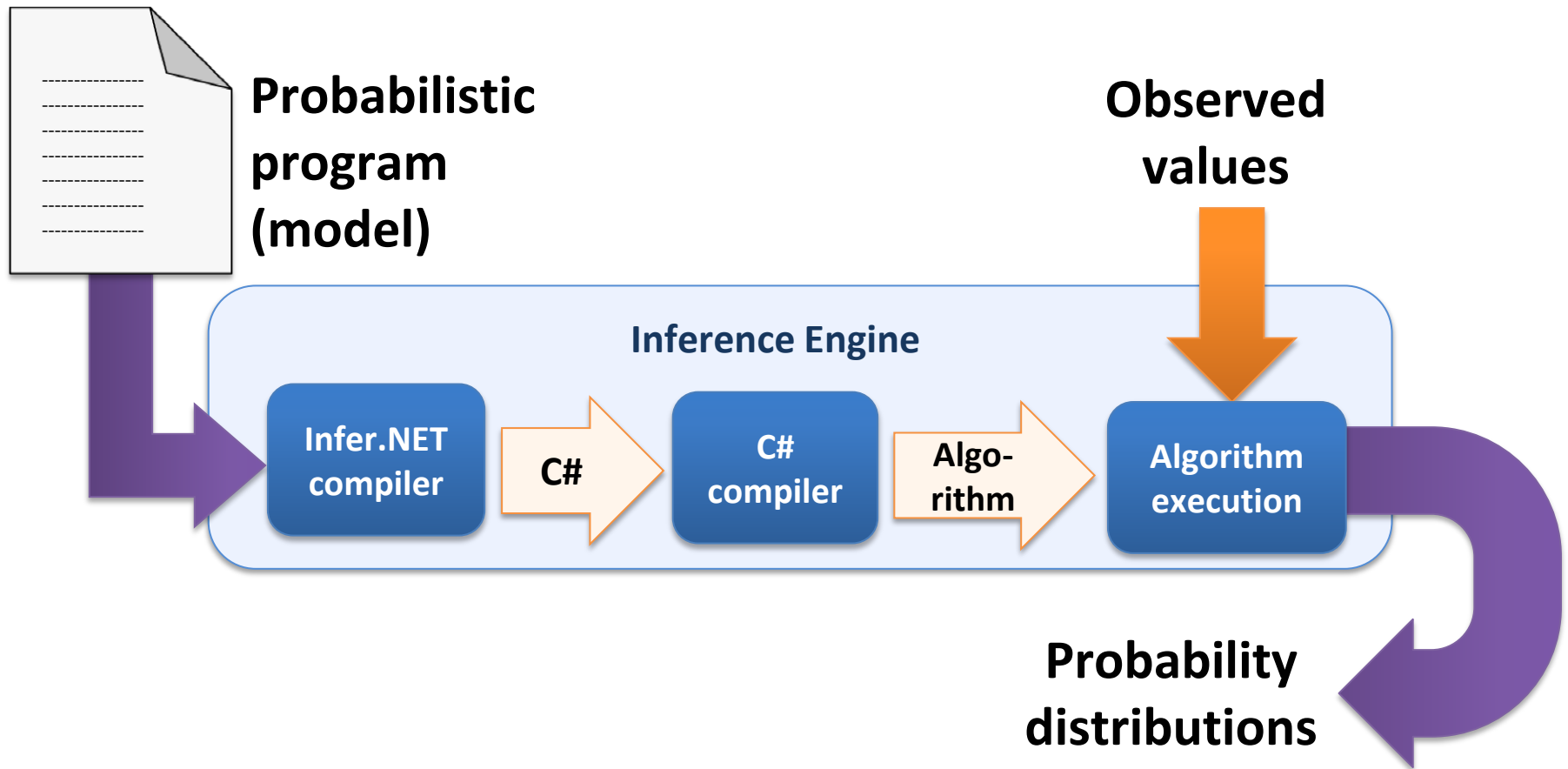


infer.net

<http://research.microsoft.com/infernet>

John Winn, Tom Minka, John Guiver, *et al.*

How Infer.NET works





DARPA ENVISIONS THE FUTURE OF MACHINE LEARNING

March 19, 2013

Automated tools aim to make it easier to teach a computer than to program it

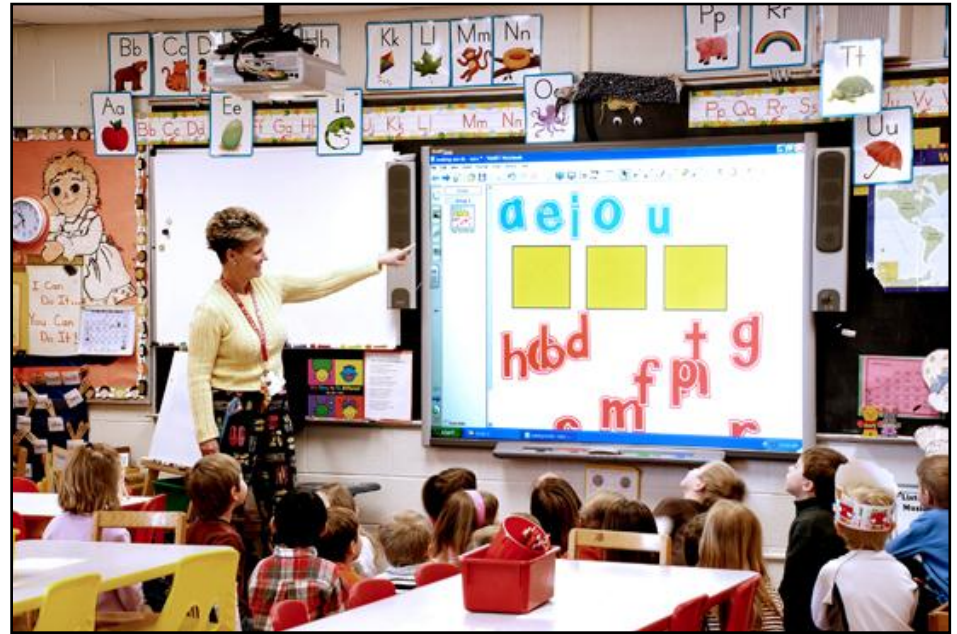
Machine learning – the ability of computers to understand data, manage results, and infer insights from uncertain information – is the force behind many recent revolutions in computing. Email spam filters, smartphone personal assistants and self-driving vehicles are all based on research advances in machine learning. Unfortunately, even as the demand for these capabilities is accelerating, every new application requires a Herculean effort. Even a team of specially-trained machine learning experts makes only painfully slow progress due to the lack of tools to build these systems.

The Probabilistic Programming for Advanced Machine Learning (PPAML) program was launched to address this challenge. Probabilistic programming is a new programming paradigm for managing uncertain information. By incorporating it into machine learning, PPAML seeks to greatly increase the number of people who can successfully build machine learning applications and make machine learning experts radically more

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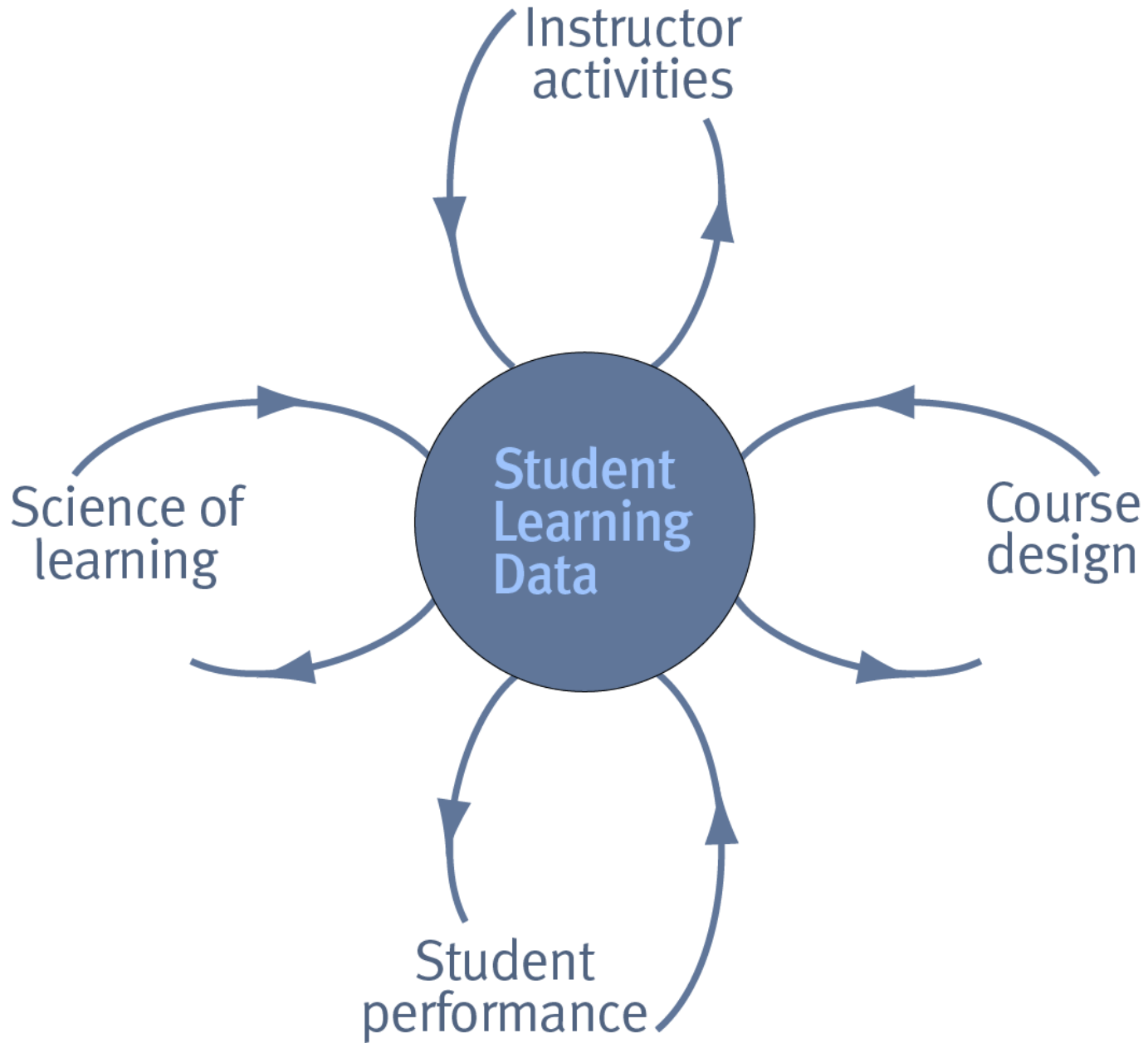
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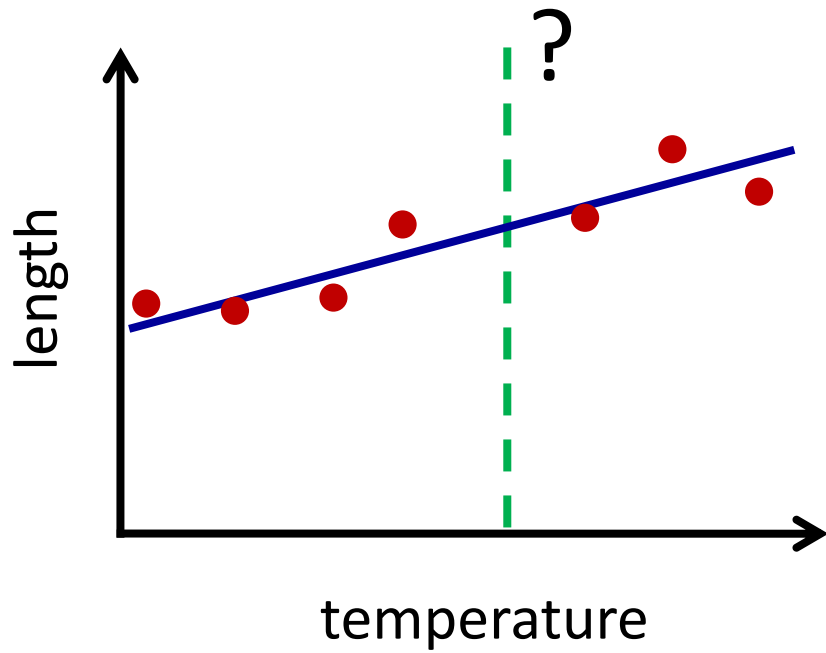
Exercise Physiology: Understanding the Athlete Within



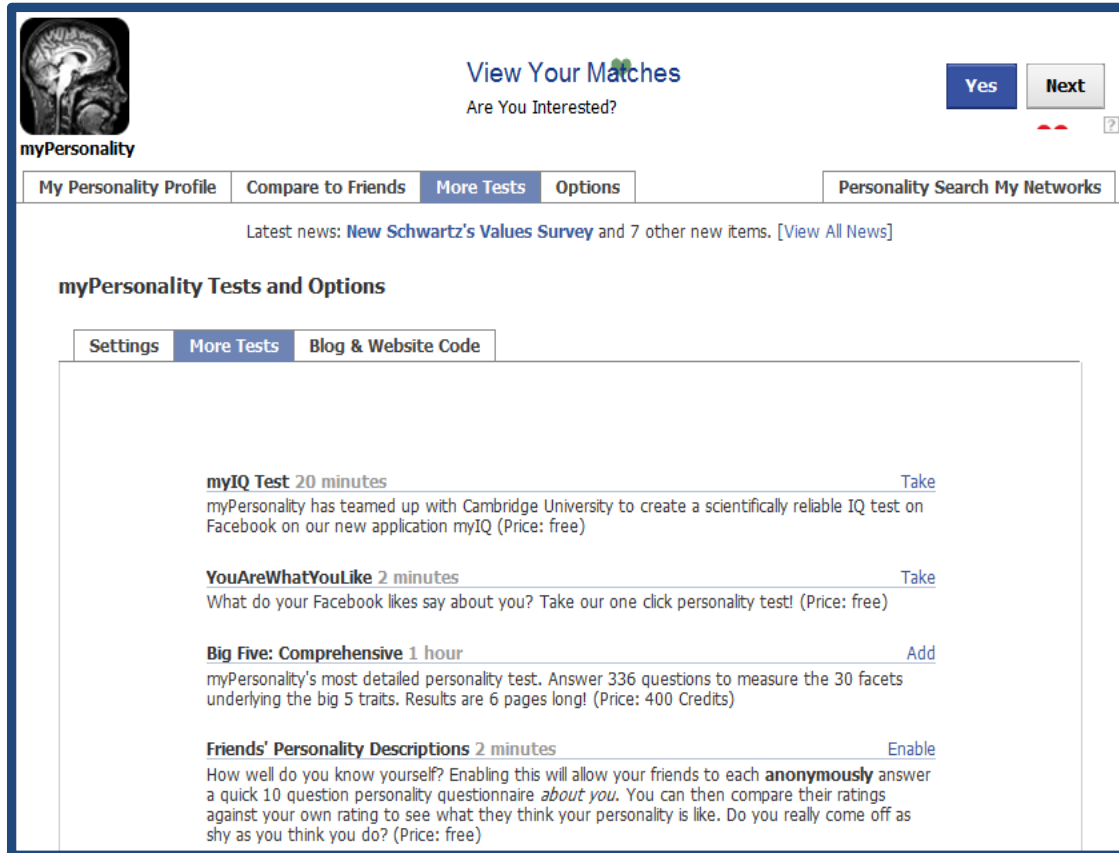
Structure Standing Still: The Statics of Everyday Objects



“Big data”



Derived Information



The screenshot shows the myPersonality website interface. At the top left is a brain scan image with the text "myPersonality" below it. To the right, the heading "View Your Matches" is displayed above the question "Are You Interested?", which has "Yes" and "Next" buttons. Below this is a navigation bar with tabs: "My Personality Profile", "Compare to Friends", "More Tests", "Options", and "Personality Search My Networks". A news section follows, mentioning "New Schwartz's Values Survey" and a link to "View All News". The main content area is titled "myPersonality Tests and Options" and contains sub-tabs for "Settings", "More Tests", and "Blog & Website Code". Four test options are listed:

- myIQ Test** 20 minutes [Take](#)
myPersonality has teamed up with Cambridge University to create a scientifically reliable IQ test on Facebook on our new application myIQ (Price: free)
- YouAreWhatYouLike** 2 minutes [Take](#)
What do your Facebook likes say about you? Take our one click personality test! (Price: free)
- Big Five: Comprehensive** 1 hour [Add](#)
myPersonality's most detailed personality test. Answer 336 questions to measure the 30 facets underlying the big 5 traits. Results are 6 pages long! (Price: 400 Credits)
- Friends' Personality Descriptions** 2 minutes [Enable](#)
How well do you know yourself? Enabling this will allow your friends to each **anonymously** answer a quick 10 question personality questionnaire *about you*. You can then compare their ratings against your own rating to see what they think your personality is like. Do you really come off as shy as you think you do? (Price: free)

www.myPersonality.org



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Daily Mail

Facebook threat to users' privacy

By Andrew Levy

FACEBOOK users are at risk of unwittingly revealing personal details simply by 'liking' pages on the site dedicated to anything from celebrities to charities, researchers warn.

Sexuality, drug use, political views and religious beliefs can be accurately predicted by monitoring users' activity on the social networking website, they said.

The team from Cambridge University focused their research on Facebook's system of liking pages - the seemingly innocuous act of clicking a button illustrated with a thumbs up.

Worryingly, the researchers found that liking even apparently unrelated information still can be used to accurately predict personal details.

For example, the researchers found drug use is suggested by 'liking' milkshakes and swimming, while high IQs are indicated by showing a taste for curly fries, and the Godfather movies.

The study was carried out by Cam-

bridge's Psychometrics Centre and based on the Facebook profiles of 58,000 people in the US.

Their 'likes' were fed into a computer algorithm which was used to predict a range of personality traits. Researchers predicted male sexuality with 88 per cent accuracy. They also had an 85 per cent success rate with political leanings and 82 per cent with religion.

Dr Gus Hosein, of campaigners Privacy International, said: 'It's a nightmare scenario that Facebook is entirely responsible for setting up. This information can be used to pre-categorise people.'

'Banks could use it to decide who gets a loan. It also creates the perfect surveillance state for governments.'

Facebook declined to comment yesterday.

How your

Murad Ahmed
Technology
Reporter

Do you feel a peculiar thrill during a thunderstorm; are you a fan of *Pride and Prejudice* who also enjoys creating scrapbooks? Then you're probably very smart, content with life and in a relationship.

Or do you prefer the sprinter Usain Bolt, have a tattoo and use an iPod? Then you're more likely to be single, a keen drinker and unhappy with your circumstances.

Those are some of the conclusions from a new study published yesterday which claims that the way we use Facebook reveals a lot about our personal characteristics and most intimate details.

Psychologists and computer scientists at the University of Cambridge have analysed tens of thousands of Facebook users, tracking the pages on which they clicked the "Like" button - blue thumbs-up sign familiar to the social network's billion users.

These likes, of anything from a political party to an amusing photograph, can be seen by a user's friends, but can also be viewed by anyone else on the internet. The researchers were able to use this Facebook activity to predict details accurately such as a person's relationship status or whether someone smoked, had divorced parents

News

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incongruous or ran a person's online al-world behaviour. ests that those who novel *Pride and Prejudice* with their life, ndorsed the page "I ctually Mean Some- o be drug users. his techniques may s to make mental But he worried that companies could s. For example, he eral regimes may be se their citizens' o persecute political eople. f these technology Google, Facebook, led. "I don't believe ta for evil reasons. use it's easy." use to comment.

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... comes big responsibility.

Internet retailing has taken this to a new level. Companies can now see what you have looked at, not just bought, thanks to "cookies".

ultimately pro... tailored to us and our needs.



Model-based machine learning

Christopher M. Bishop

Phil. Trans. R. Soc. A 2013 371,
doi: 10.1098/rsta.2012.0222

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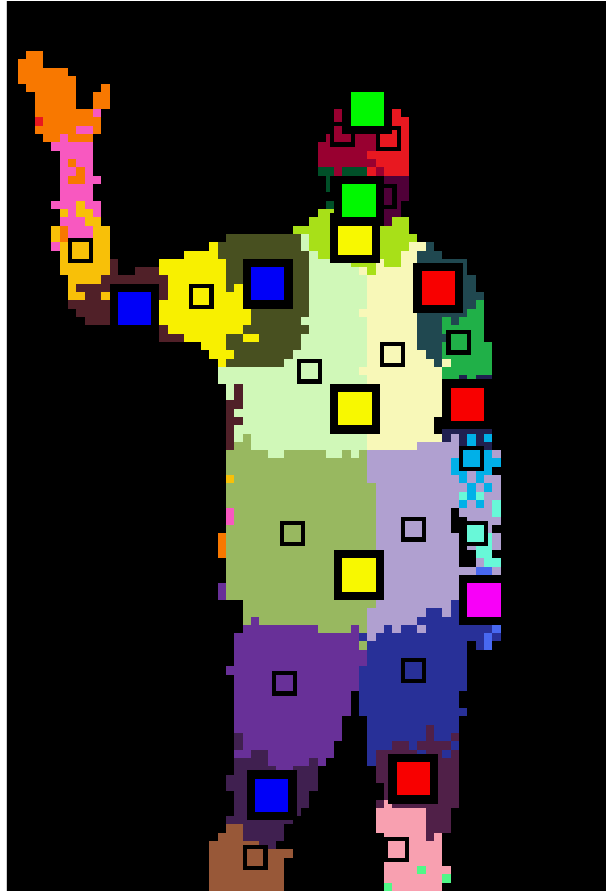
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**PATTERN RECOGNITION
AND MACHINE LEARNING
CHRISTOPHER M. BISHOP**



Thank you!