

37458

# Advanced Bayesian Methods

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University of Technology Sydney

## Learning Strategy

- Assignments.
- Computer laboratories.
- Class exercises and discussion.
- Some, but not many, slides.

Main classroom rule next...

You Have Just Entered a ...

# SCREEN-FREE ZONE

## Classroom Rules

- NO switched on mobile phones.
- NO texting.
- NO \*exting.
- NO open iPads.
- NO iPods.
- NO other iDevices.
- NO open laptops.

## Classroom Rules (continued)

- NO tinding.
- NO you-tubing.
- NO tumbling.

## Classroom Rules (continued)

- NO facebooking.
- NO tweeting.
- NO twittering.
- NO googling.
- NO snapchatting.
- NO instagramming.
- NO google glassing.

Yes, this class is a ...

# SCREEN-FREE ZONE

## Clarifications?

Just to be sure... that's **NO** to:

- switched on mobile phones.
- texting.
- \*exting.
- open iPads.
- iPods.
- other iDevices.
- open laptops.
- facebooking.
- tweeting.
- twittering.
- googling.
- snapchatting.
- instagramming.
- google glassing.
- tinding.
- you-tubing.
- tumbling.

## Lecturer's Recent History (Last 20 Years)

- 2011-: Distinguished Professor of Statistics at **University of Technology Sydney**.
- 2007-2010: Research Professor in Statistics at **University of Wollongong**.
- 2003-2006: Professor of Statistics at **University of New South Wales**.
- 1997-2002: Associate Professor of Biostatistics at **Harvard School of Public Health, USA**.

## Some Indicators that Stats is Important in 2019

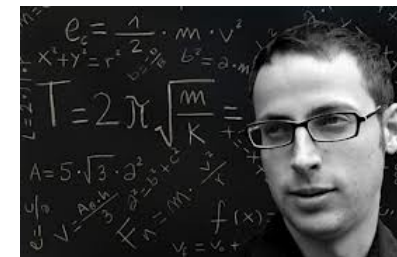
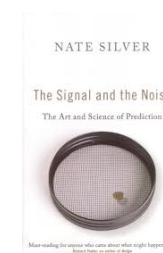
- Rise of **Kaggle** (Sydney origin).
- Recent press articles on **Big Data** such as:  
[www.nytimes.com/2015/05/03/opinion/sunday/how-not-to-drown-in-numbers.html](http://www.nytimes.com/2015/05/03/opinion/sunday/how-not-to-drown-in-numbers.html)
- Google YouTube videos.
- **Big Data** book **The Signal and the Noise** by **Nate Silver** makes New York Times Best-Seller (non-fiction) list early 2013.

## **BIG** data Book Recent Best-Seller!

# The Signal and the Noise

The Art and Science of Prediction

by Nate Silver



Reached **Number 2** on the **New York Times Best-Seller** list (non-fiction).

## Some BIG data Examples

- Internet marketing.
- Business analytics.
- Weather forecasting.
- Baseball player performance.

(Did you see 'Moneyball'?)

- Election forecasting.

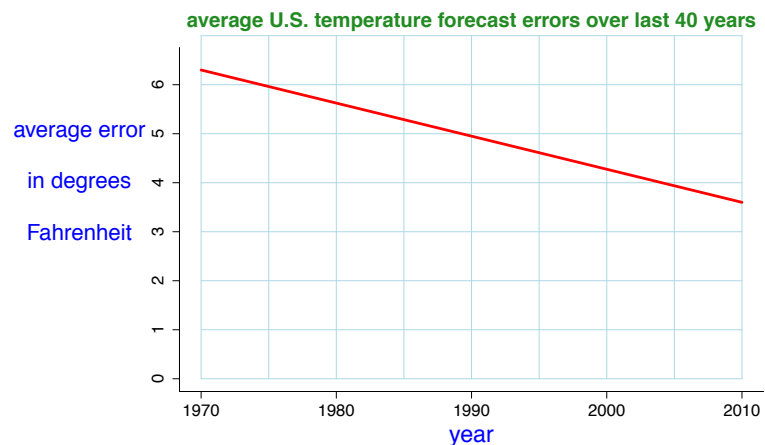
(Nate Silver predicted all 50 states in 2012 U.S. presidential election)

- Genomics.

(Medical treatment personalised for your genes)

Two minute YouTube video (Varian)...

## Example Figure from Nate Silver Book



## Main Topics for First Half

Topic 1 Probabilistic Graph Theory

Topic 2 Bayesian Statistical Inference

Second Half to Be Determined  
(After I Get to Know You Better!)

## Major Goal for this Subject

By Week 6, tool you up to be able to do

**ANY\***

data analysis, no matter how complex,

– and understand the underlying maths.

\* To be qualified later.

## Reminder of Our Goal Until Week 6

Tool you up to be able to do

**ANY\***

data analysis, no matter how complex,

– and understand the underlying maths.

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## Path to Achieving Goal

- Draft book chapters of GRAPH THEORY AND STATISTICS by M.P. Wand.
- The R computing environment.
- The BUGS and Stan inference engines and their interface with R.
- **IMPORTANT: no assumed knowledge of any of the above!**

## Impetus for Topics 1 and 2

GRAPHICAL MODELS approach to **Advanced Data Analysis:**

- is very powerful
- goes well beyond **Statistics**, including **Machine Learning**
- important for confronting the **BIG DATA** era.

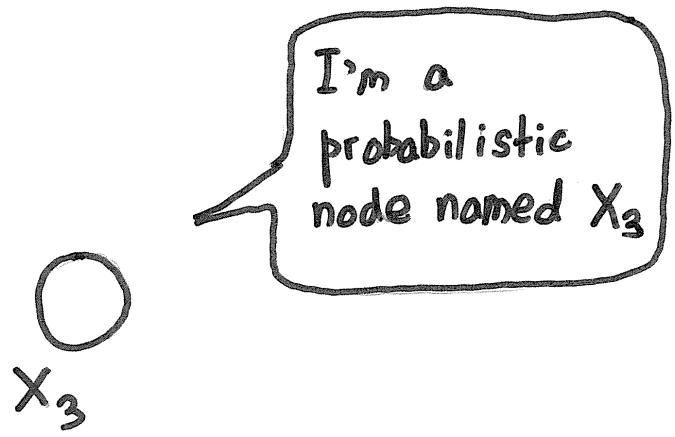
# THE SEX LIFE OF NODES



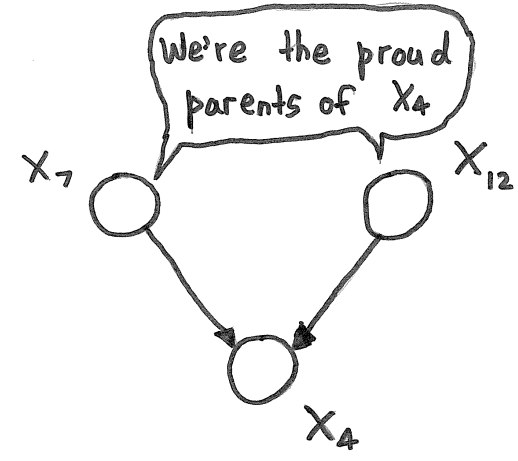
**QUESTION:** What is a node?

**ANSWER:** A node is an abstract mathematical (set-theoretic) entity, usually depicted as a circle in books and papers.

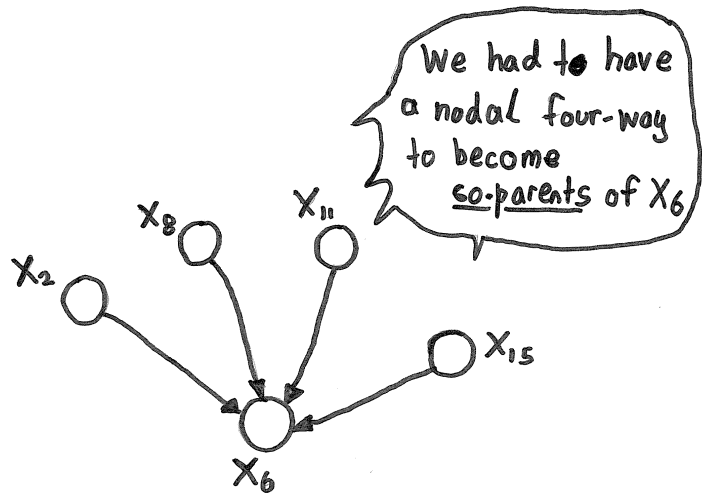
Nodes attached to random variables are called probabilistic nodes



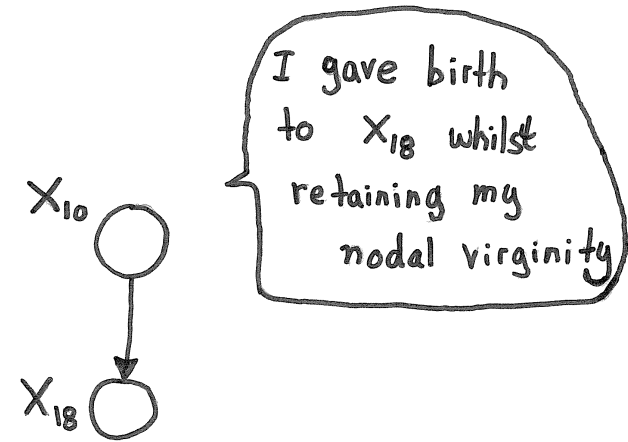
Nodal sex leads to baby nodes...



Nodal sex much more intriguing than in the human and animal worlds...

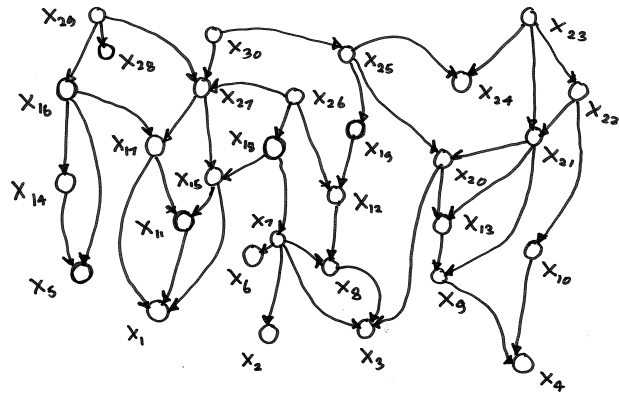


... including even virgin births!

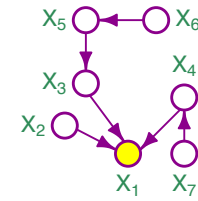


Finally, there is the nodal free-for-all...

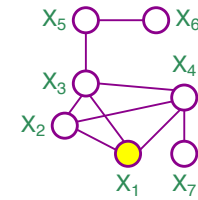




DAG (lots of nodal sex)



Undirected graph (no sex, more like holding hands)

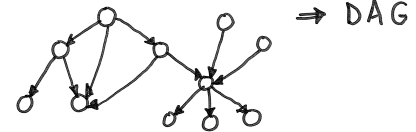


### Two Types of Node Gatherings

- DAGs.
- Undirected graphs.

### DAGs have Rules

A nice wholesome node family



Too much weird stuff ⇒ not a DAG

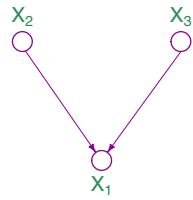


**INTRODUCING:** Bob, Jessica and Nathaniel

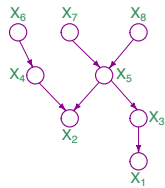
**Bob the DAG**



**Jessica the DAG**



**Nathaniel the DAG**



... and Nathaniel the dag



Not to be confused with...

**Bob the dag,**



**Jessica the dag...**

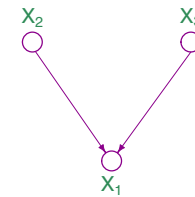


Bob, Jessica and Nathaniel the DAGs

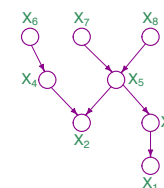
**Bob the DAG**



**Jessica the DAG**



**Nathaniel the DAG**



Subject Web-Site

[matt-wand.utsacademics.info/37458.html](http://matt-wand.utsacademics.info/37458.html)

(or Google 'Matt Wand' and follow link)

Last Items Before Break

# QUESTIONS?

and then

INTRODUCTIONS IF WE HAVE TIME