

Introduction

MATH2269 Applied Bayesian Statistics

Dr. Haydar Demirhan | RMIT University | School of Science | Mathematical Sciences

The Lecturer

- Dr. Haydar Demirhan
 - Office: 08 09 83 [REDACTED]
 - e@mail: haydar.demirhan@rmit.edu.au
- Past teaching experience (since 2009):
 - Introduction to Statistics
 - Bayesian Statistics
 - Simulation Methods
 - Estimation Methods
 - Probability Theory
 - Time Series Analysis
 - Applied Bayesian Statistics
 - Forecasting

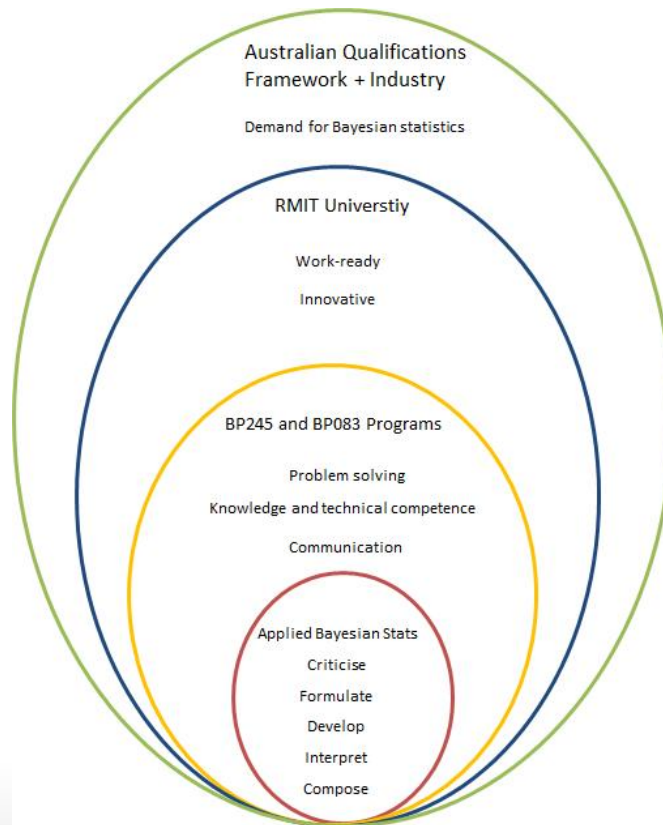
Research interests:

- Bayesian analysis of categorical data
 - Log-linear modeling
 - Estimation of odds ratios
 - Multivariate prior distributions
 - Zero-inflated models
- Monte Carlo simulation
 - Resampling methods
 - Cryptographic randomness
 - Discrete event simulation
- Solar radiation modelling
 - Symbolic regression based genetic programming
 - Linear and nonlinear models
 - Fuzzy approaches

A new course...

Applied Bayesian Statistics

- MATH2269 Applied Bayesian Statistics course is offered by the programs
 - [MC242 - Master of Analytics](#) and
 - [MC004 - Master of Statistics and Operations Research](#).
- This course contributes to the following learning outcomes of these programs:
 - Knowledge and technical competence,
 - Problem-solving, and
 - Communication.
- You may combine your work during the semester in a Bayesian e-portfolio.





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Job Search

\$150k+ Jobs

Profile

Company Reviews

Career Advice

What

Bayesian



Any Classification



Where

Enter suburb, city, or region

SEEK

All work types

paying \$0

to \$200k+

listed any time

17 jobs found

Sorted by **relevance**

✉ Receive new jobs for this search by email

Enter your email

Create alert

IT Senior Data Scientist

3d ago

Peoplebank Australia NSW

Sydney

Information & Communication Technology > Other

- Exciting role with Government
- Located in Sydney CBD
- Attractive rates

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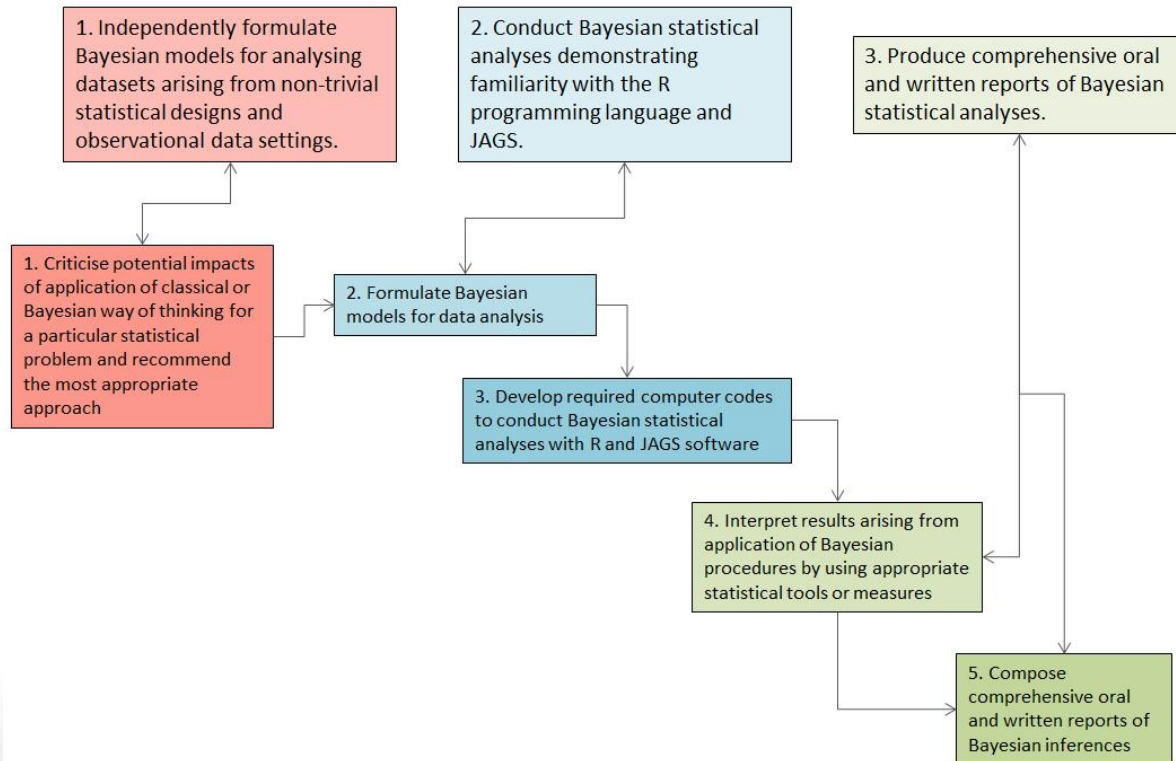
Gain new skills.
Make new friends.
Make a difference.

YOU
CAN
HELP




Start

Learning Outcomes, Their Breakdown and Relationship



Learning Management System: Canvas



- Account
- Dashboard
- Courses
- Calendar
- Inbox
- Arc
- Commons
- Help

≡ MATH2269

PGRD Semester 2 2018 ...

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Echo360 (MATH2269_18PC AP)

Settings

Recent Announcements




Welcome

Hi All, Welcome to the first week of the Applied Bayesian Analysis course. It's a pleasure for me to teach this course t...

Posted on: Jul 11, 2018 at 12:00

Applied Bayesian Statistics (050645)

Edit⋮



Applied Bayesian Statistics

MATH2269

School of Science

Course Welcome and Orientation


Welcome to the *MATH2269 Applied Bayesian Analysis* course! In this course, you will improve your analytics skillset with a working knowledge of Bayesian analysis as applied in economics, engineering and the natural and social sciences. To get started, please see the 'Welcome and Orientation' module which includes important information you need to know about the course, then access the relevant week/topic as needed during the course.

Course Status

☐ Unpublish☒ Published

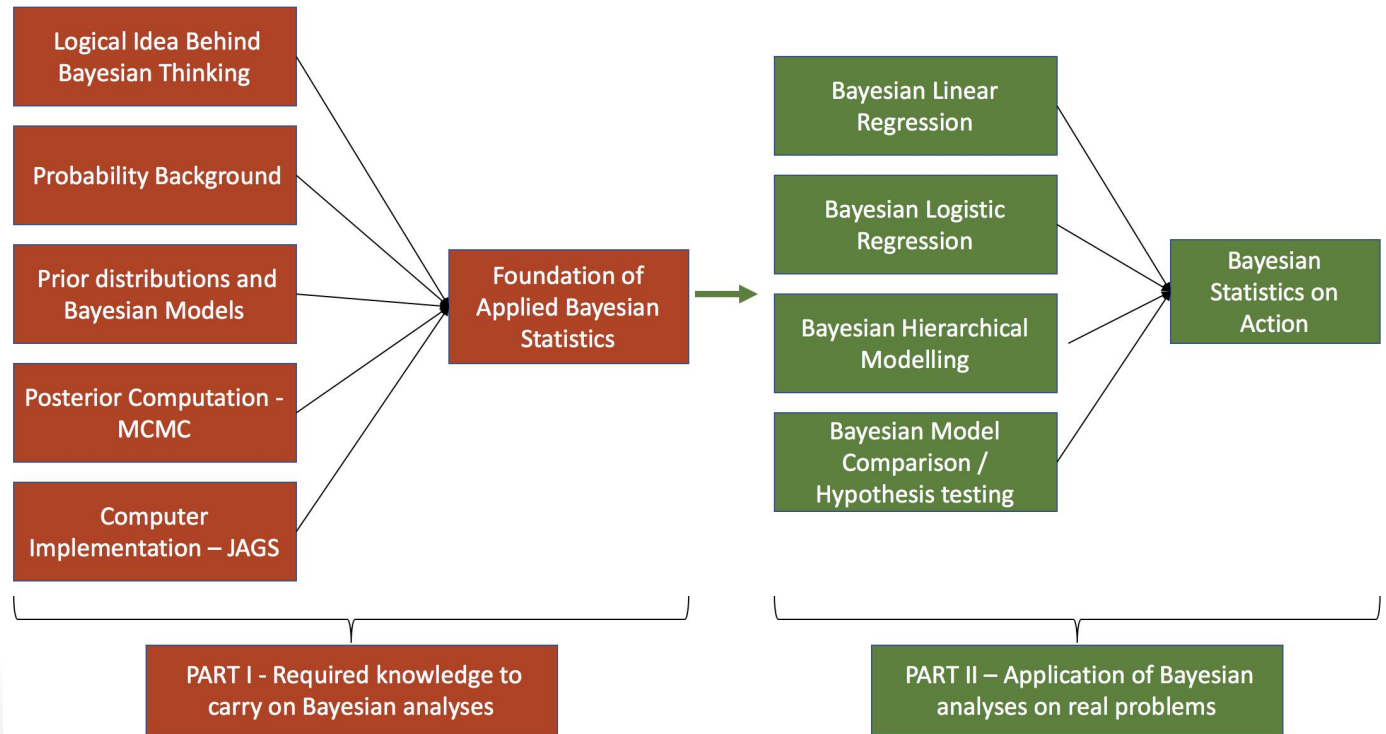
Coming Up

Nothing for the next week



Need Help

Description of the Course



Communication

- **Office hours:** Tuesday::: 04:00pm - 05:00pm
- **Discussion board:** See Canvas shell for "Course discussion board." Please use the relevant discussion board to your query!
- **Email:** Anytime. Please put "MATH2269" to the subject line of your email.

Teaching Schedule

Week	Module	Assessment Deadlines
1	Module 1: Burn-in	
2	Module 2: Probability	
3	Module 3: Bayes' Rule	
4	Module 4: Markov Chain Monte Carlo Methods	Assignment 1 (5%) (12.08.2018, 11:59 pm)
5	Module 5: JAGS	
6	Catch-up Class	Mid Semester Test (20%) (21.08.2018, 06:30 pm - 08:00 pm)
Break		
7	Module 6: Bayesian Linear Regression	
8	Module 7: Bayesian Logistic Regression	
9	Module 8: Hierarchical Models	Assignment 2 (15%) (23.09.2018, 11:59 pm)
10	Module 9: Model Comparison	
11	Catch-up Class	
12	Project Presentations	Course Project (20%) (Presentations: 09.10.2018, 05:30 pm - 08:30 pm) (Written reports: 21.10.2018, 11:59 pm)
SWOT-VAC		
Exams		Supervised Test (40%) (TBA)

Assessment

We will have the following assessments:

No	Assessment Task	Weighting	Contents
1	Assignment 1	5%	On the logic behind the Bayes Theorem
2	Mid Semester Test	20%	Modules 1 to 5
3	Assignment 2	15%	Bayesian analysis of a data set
4	Final project	20%	Bayesian analysis of a data set
5	End of Semester Test	40%	Modules 1 to 9

Mapping of assessments with learning outcomes:

Alignment of Assessment Tasks and Learning Outcomes						
Assessment task	CLO1	CLO2	CLO3	CLO4	CLO5	Type of assessment task
1						Assignment 1
2						Mid semester test
3						Assignment 2
3						Assignment 3
4						End of semester test

Assessment

Mid-Semester test will be a regular pen-and-paper based test. It will focus on

- the conceptual understanding of the foundations of Bayesian statistics,
- outputs of Apps and their interpretation.

You will sit in the mid-semester test in Week 6 in the usual classroom.

Final test will be a regular pen-and-paper based test. It will focus on

- the conceptual understanding of the Bayesian statistics,
- outputs of Apps and their interpretation,
- JAGS `model{}` and `data{}` statements and interpreting outputs of JAGS.

Assessment

Final Project will include finding an interesting dataset and applying Bayesian methods to solve the problem associated to the dataset.

Focus on the datasets for _____ or _____ analyses.

Groups of maximum 5 students and it's possible to work on it independently.

Email the group members to me at the earliest.

You will give a video or class presentation and submit a written report for the final project.

It's highly recommended to start thinking/working on it from the Day 1 of the semester.

Assessment

Some teachers



Source: <https://blog.2shopper.com/2013/08/29/some-other-things-to-do-at-the-beach/>

Teach to do in classroom



Source: <https://blog.2shopper.com/2013/08/29/some-other-things-to-do-at-the-beach/>

Expect to get in exam

Assessment

My expectation



Source: <http://6iee.com/606258.html>

Teach to do in classroom



Source: <http://6iee.com/606258.html>

Expect to get in exam

Assessment

Your turn



Source: <http://6iee.com/606258.html>

Learn in classroom



Source: <http://www.bayviewresort.com/>

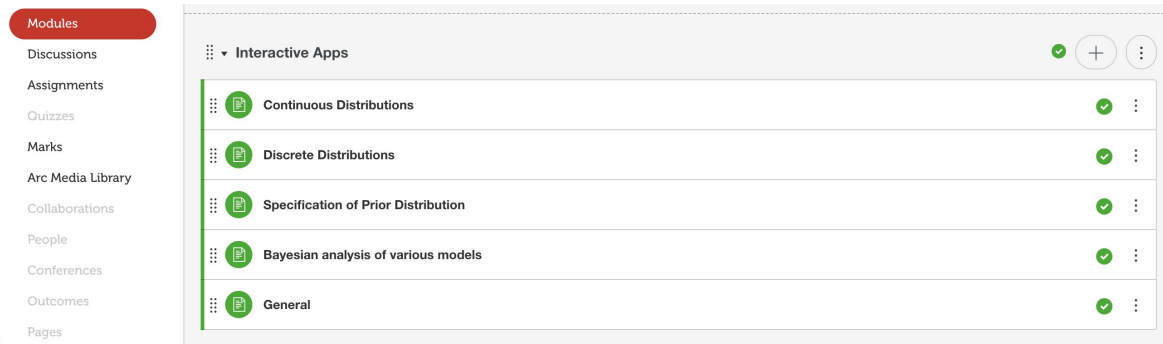
Apply at work

Use of New Technology

Use of new technologies is necessary for a successful demonstration of key points in Bayesian statistics.


So, I have developed 31 Shiny apps to demonstrate the context in this course.

You can find the app under the Modules section of the Canvas shell.



Use of New Technology

10th International Conference on Teaching Statistics - ICOTS10 Kyoto, Japan 8 – 13 July 2018.



Use of Interactive Apps in Teaching Bayesian Statistics

Haydar Demirhan and James Baglin

RMIT University, School of Science, Mathematical Sciences, Melbourne, Australia

Introduction

- Bayesian data analysis requires simultaneous use of statistical theory and statistical computation.
- Use of new technologies is necessary for a successful demonstration of key points like specification of prior distribution and effect of the weight of prior distribution in the posterior distribution in the context of Bayesian statistics.
- static visualisations are not always sufficient for explaining the interacting relationships among multiple parameters in a Bayesian model.
- To overcome the difficulties in explaining visualising key concepts to students, we developed some data visualisation teaching apps using Shiny.
- Use of the apps in Bayesian teaching makes it more effective to explain complex ideas of Bayesian paradigm and measure conceptual understanding of students in a practical way.

Shiny Apps

- There is an increasing interest in using Shiny in teaching statistics in the statistics education literature (Sigal and Chalmers, 2016; Ross, 2017; Williams and Williams, 2018).
- The apps aimed to dynamically visualise hard to imagine key concepts and the impact of changing parameter values on the results of Bayesian analyses.
- The apps were embedded in reproducible and elegantly formatted documents using R Markdown, outputs of which are fully compatible with major web browsers and learning management systems, and used to demonstrate related issues in class times.
- They are hosted on a Shiny server to utilise the interactivity of the Internet in the use of the apps.
- The technology used to develop apps was the R package called Shiny [<http://shiny.rstudio.com/>] which provides functionality to develop interactive visualisations.
- The developed apps were embedded into lecture notes using R Markdown [<http://rmarkdown.rstudio.com/>], which essentially combines R, Python, and SQL code chunks with text and produces a fully reproducible document in widely used static and

Use of Apps for posterior inferences

- Another type of app used to teach prior specification includes the likelihood function, prior and posterior distributions within the same frame.
- In the left panel of the app, the mean and variance of prior distribution, the average of the observed sample from the normally distributed population, known population variance and sample size are adjusted using the slider bars.
- On the right panel, the likelihood function and prior and posterior distributions are plotted and the corresponding posterior estimate of the population mean ($E(\mu|x)$) and its variance ($V(\mu|x)$) are displayed.

Bayesian Analysis with Normal Prior and Normal Population with Known Variance

```
##
##
## Developed by Dr. Baydar Demirhan
## Email: baydar.demirhan@rmit.edu.au
##
```

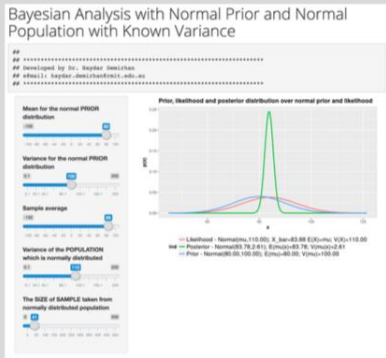


Figure: The app designed to demonstrate the relationship between likelihood function, prior and posterior

Weekly Hands on Tasks

Starting from Module 2, we will have hands-on task sessions in the last hour of each week.

You will be given a bunch of tasks on the apps, R, JAGS, or real datasets related with the context of the covered module.

I'll be around with 2 tutors to help you on doing these tasks. This is very important in terms of developing some experience in the application of Bayesian statistics and interpretation of the results.

I'll demonstrate and record the solution at the beginning of each week depending on the tasks.

So, please attend these sessions to take as much as possible from this course.

Feedback

Student feedback is one of the important elements of this course. [Good feedback](#) brings along effective reflection! Please provide timely feedback using the following channels:

- Class discussions,
- Email,
- Office hours,
- Discussion board on Canvas,
- [Socrative](#) (using the room **BAYESPG**)
- CES

Bayesian Community

There is a substantially growing Bayesian community in the world of statistics.

The main body of the Bayesian community is

[International Society for Bayesian Analysis](#).

Website of ISBA: <https://bayesian.org/>

[Statistical Society of Australia](#) has also a section for [Bayesian Statistics](#)

Website of SSAI: <http://www.statsoc.org.au/>

QUESTIONS ??