

WESTERN SYDNEY
UNIVERSITY



School of Computer, Data and Mathematical Sciences



Learning Guide

301109 Visual Analytics
Autumn 2020

Unit Details

Unit Code:	301109
Unit Name:	Visual Analytics
Credit Points:	10
Unit Level:	2
Assumed Knowledge:	Familiarity with computer software programs, such as Microsoft Office.

Note: Students with any problems, concerns or doubts should discuss those with the Unit Coordinator as early as they can.

Unit Coordinator

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Wednesday 12:00-13:00 (Parramatta South Campus, Room ER.G.18)

Teaching Team

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Note: The relevant Learning Guide Companion supplements this document

1 About Visual Analytics

1.1 An Introduction to this Unit

This unit introduces the fundamentals and technologies of visual analytics to understand big data. It covers major concepts of information visualisation, human computer perception and methods for visual data analysis. Students will learn knowledge and skills for identifying suitable visual analytics techniques, methods and tools for handling various data sets and applications. The unit provides students with opportunities to explore novel research in visual analytics and visualisation.

1.2 What is Expected of You

Study Load

A student is expected to study an hour per credit point a week. For example a 10 credit point unit would require 10 hours of study per week. This time includes the time spent within classes during lectures, tutorials or practicals.

Attendance

It is strongly recommended that students attend all scheduled learning activities to support their learning.

Online Learning Requirements

Unit materials will be made available on the unit's vUWS (E-Learning) site (<https://vuws.westernsydney.edu.au/>). You are expected to consult vUWS at least twice a week, as all unit announcements will be made via vUWS. Teaching and learning materials will be regularly updated and posted online by the teaching team.

This is a small class. Face-to-face interactions are essential so that the student can learn concepts, technologies and tools. Student are also using the vUWS site for discussing materials, techniques and related work

Special Requirements

Essential Equipment:

Access to a Computer.

Legislative Pre-Requisites:

Not Applicable

Policies Related to Teaching and Learning

The University has a number of policies that relate to teaching and learning. Important policies affecting students include:

- [Assessment Policy](#)
- [Bullying Prevention Policy](#) and
- [Guidelines](#)
- [Enrolment Policy](#)
- [Examinations Policy](#)
- [Review of Grade Policy](#)
- [Sexual Harassment Prevention Policy](#)
- [Special Consideration Policy](#)
- [Student Misconduct Rule](#)
- [Teaching and Learning - Fundamental Code](#)

– Student Code of Conduct

Academic Integrity and Student Misconduct Rule

In submitting assessments, it is essential that you are familiar with the policies listed above and that you understand the principles of academic integrity. You are expected to act honestly and ethically in the production of all academic work and assessment tasks, submit work that is your own and acknowledge any contribution to your work made by others.

Important information about academic integrity, including advice to students is available at https://www.westernsydney.edu.au/studysmart/home/academic_integrity_and_plagiarism. It is your responsibility to familiarise yourself with these principles and apply them to all work submitted to the University as your own.

When you submit an assignment or product, you will declare that no part has been: copied from any other student's work or from any other source except where due acknowledgement is made in the assignment; submitted by you in another (previous or current) assessment, except where appropriately referenced, and with prior permission from the Unit Coordinator; written/produced for you by any other person except where collaboration has been authorised by the Unit Coordinator.

The Student Misconduct Rule applies to all students of Western Sydney University and makes it an offence for any student to engage in academic, research or general misconduct as defined in the Rule.

The University considers plagiarism, cheating and collusion as instances of academic misconduct. The University also considers submitting falsified documentation in support of applications for special consideration, including sitting of deferred examinations, as instances of general misconduct. You should be aware that changes were made to the Student Misconduct Rule commencing 1 January 2020 that provide for minimum sanctions that apply to certain conduct, including the provision of falsified documentation to the University.

You are strongly advised to read the [Student Misconduct Rule](#) and the Inappropriate Behaviour Guidelines at the commencement of each session to familiarise yourself with this process and the expectations of the University in relation to work submitted for assessment.

1.3 Changes to Unit as a Result of Past Student Feedback

The University values student feedback in order to improve the quality of its educational programs. The feedback provided helps us improve teaching methods and units of study. The survey results inform unit content and design, learning guides, teaching methods, assessment processes and teaching materials.

You are welcome to provide feedback that is related to the teaching of this unit. At the end of the semester you will be given the opportunity to complete a Student Feedback on Unit (SFU) questionnaire to assess the unit. You may also have the opportunity to complete a Student Feedback on Teaching (SFT) questionnaire to provide feedback for individual teaching staff.

As a result of student feedback, the following changes and improvements to this unit have recently been made:

- Update in lecture and tutorial materials.

2 Assessment Information

2.1 Unit Learning Outcomes

This unit introduces the fundamentals and technologies of visual analytics to understand big data. It covers major concepts of information visualisation, human computer perception and methods for visual data analysis. Students will learn knowledge and skills for identifying suitable visual analytics techniques, methods and tools for handling various data sets and applications. The unit provides students with opportunities to explore novel research in visual analytics and visualisation.

	Outcome
1	Explain the purpose of information visualisation and visual analytics
2	Identify strengths, limitations and opportunity of visualisation and visual analytics techniques
3	Apply common visualisation techniques for relational and multi-dimensional data
4	Identify dimensionality reduction methods for high dimensional data
5	Explain methods for spatio-temporal data visualisation
6	Employ common visualisation and visual analytics tools for big data analysis

2.2 Approach to Learning

This unit is a 10 credit point unit and will require your full and continuous attention to maintain the highest possible grades. It is expected that you will spend at least 10 hours each week (on average) which includes face-to-face (lectures and tutorials/practicals) and self study (reading online materials and teaching materials, and completing assessment tasks). Some weeks you will spend more time on learning activities and assessments and in other weeks the workload will be somewhat less. Lectures are a key element of your learning environment in this unit. The lectures will focus on familiarising the students with the theoretical concepts of the unit content. Whilst attendance in lectures is not compulsory, it is highly recommended. All content covered in lectures is examinable. The lecture sets the context for the practical the following week and will highlight concepts and skills you will need for the formal final examination. Practicals/tutorials provide the opportunity for learning in a smaller class context. The practicals/tutorials are designed for further discussion of the theoretical concepts covered in lectures, as well as exploration of the practical concepts and samples involved in developing programs for computer graphics. Along with your lectures, the practicals/tutorials are designed to help you develop the knowledge and skills that will form the basis upon which you will be assessed in the quiz, as well as give you the knowledge and skills required to complete the assignments. The practicals/tutorials enables students to maintain adequate performance and continuity of their tutorial/practical program and tutors to maintain contact, monitor their students progress as well as provide verbal feedback of your work and understanding outside of formal assignment feedback. Students should access vUWS and/or check their student email account(s) at least twice a week for teaching materials, announcements and reading materials, documents and other information.

2.3 Contribution to Course Learning Outcomes

3734: Bachelor of Data Science

Course Learning Outcomes	ULO 1	ULO 2	ULO 3	ULO 4	ULO 5	ULO 6
1. collect or design the collection of data and extract, transform and load the data into an analysis system					Developed	Introduced
2. visualise and present data to understand its information content and find patterns or trends		Developed	Introduced		Developed	
3. build models and write computer code to make predictions, test hypotheses and validate conclusions drawn from the analysis process					Introduced	Introduced
4. formulate problems and use data ethically and responsibly to provide information and advice that is reliable, valid, timely and relevant for their chosen specialty.	Introduced			Introduced		
5. present results and define actions to be taken to generate impact in application domains		Introduced			Introduced	
6. provide interpretive and predictive reports for professional colleagues to inform decision-making			Introduced			Introduced
7. advise on the technical validity and reliability of interpretations and predictions based on analysis of large data sets		Introduced		Introduced		
8. advise on the methods and ethics of data collection and use within a professional context.	Introduced		Introduced			

3687: Bachelor of Information Systems

Course Learning Outcomes	ULO 1	ULO 2	ULO 3	ULO 4	ULO 5	ULO 6
1. Communicate in a professional manner with others at all levels within and beyond the industry and across discipline, cultural and national boundaries, orally, in writing and through presentations.	Developed					Introduced
2. Understand the importance of a strong synergies between people, processes and selected technologies.	Introduced	Developed		Developed		
3. Research, plan, implement and monitor systems to provide appropriate and ongoing quality assurance in respect to all work undertaken according to current standards in the computing industry.		Introduced	Developed	Introduced	Developed	
4. Perform work of high quality with an awareness of the professional code of conduct, professional and personal ethics, and the legal and social implications of technological change and professional practice						Introduced
5. Work independently and as a member of a team, including cross-discipline teams, and plan, manage and report on personal and project deliverables			Introduced		Introduced	Developed
6. Innovate, research and look for new technologies and tools that can assist businesses when implementing cutting edge information systems.	Introduced	Introduced		Introduced		

3688: Bachelor of Information Systems Advanced

Course Learning Outcomes	ULO 1	ULO 2	ULO 3	ULO 4	ULO 5	ULO 6
1. Communicate in a professional manner with others at all levels within and beyond the industry and across discipline, cultural and national boundaries, orally, in writing and through presentations.	Developed					Introduced
2. Understand the importance of a strong synergies between people, processes and selected technologies.	Introduced	Developed		Developed		
3. Research, plan, implement and monitor systems to provide appropriate and ongoing quality assurance in respect to all work undertaken according to current standards in the computing industry.		Introduced	Developed	Introduced	Developed	
4. Perform work of high quality with an awareness of the professional code of conduct, professional and personal ethics, and the legal and social implications of technological change and professional practice						Introduced
5. Work independently and as a member of a team, including cross-discipline teams, and plan, manage and report on personal and project deliverables			Introduced		Introduced	Developed
6. Innovate, research and look for new technologies and tools that can assist businesses when implementing cutting edge information systems.	Introduced	Introduced		Introduced		
7. Become an active member of UWS research groups and teams and under supervision engage in cutting edge research, developments and implementations of innovative state of the art technologies.		Introduced		Introduced		

2.4 Assessment Summary

The assessment items in this unit are designed to enable you to demonstrate that you have achieved the unit learning outcomes. Completion and submission of all assessment items which have been designated as mandatory or compulsory is essential to receive a passing grade.

To pass this unit you must:

Obtain at least 50% as a total value of all your assessment scores and satisfactory marks for tutorials (i.e. at least 30% in average)

Item	Weight	Due Date	ULOs Assessed	Threshold
Practical: Tutorial Labs -10 marked sessions (2% each)	20%	Weekly in your allocated tutorial day/time	1 - 6	No
Applied Project: (Individual) The students are required to develop an effective visualisation for relational data using existing tools or software	30%	Week 8, 24/04/2020	1, 3, 6	No
Applied Project: (Group) The students are required to develop an effective visual analytics work for multi-dimensional data using existing tools or software.	30%	Week 14, 05/06/2020	1, 3, 5, 6	No
Intra-session Exam: Closed book, multiple choice	20%	Week 14 at usual lecture hour	1, 2, 4, 5	No

Feedback on Assessment

Feedback is an important part of the learning process that can improve your progress towards achieving the learning outcomes. Feedback is any written or spoken response made in relation to academic work such as an assessment task, a performance or product. It can be given to you by a teacher, an external assessor or student peer, and may be given individually or to a group of students. As a Western Sydney University student, it is your responsibility to seek out and act on feedback that is provided to you as a resource to further your learning.

In this unit, you can expect feedback to student's work on tutorial exercises orally during the demonstrations. The feedback to your work on assignments will be delivered on the return of the test results. Detailed feedback will be given by the lecturer(s) upon requests at the consultation hours. Further informal feedback may also be provided in lectures and tutorials.

2.5 Assessment Details

2.5.1 Practical: Tutorial Labs -10 marked sessions (2% each)

Weight:	20%
Type of Collaboration:	Individual
Due:	Weekly in your allocated tutorial day/time
Submission:	In Class
Format:	Weekly attendance and completion of corresponding exercises
Length:	2 hours for each session
Curriculum Mode:	Practical

This assessment will be made up of a series of tutorial questions relating to the unit content and the assignments. Examine materials from previous lecture(s). This weekly tutorial/practical exercises provide students with a continuous feedback on how they are progressing. It also provides an opportunity for each student knowing the progress toward the completion of the assignments.

Count 20% of the total assessment scores. Marking is based on the weekly attendance and satisfactory completion of the corresponding exercises (10 marked tutorial sessions).

Resources:

Check lecture notes and vUWS for information

Marking Criteria:

Criteria	High Distinction	Distinction	Credit	Pass	Unsatisfactory
Attendance and participation in discussion (30%)	Participation in tutorials with active contribution in the discussion	Participation in tutorials with good contribution in the discussion	Participation in tutorials with some contribution in the discussion	Partial participation in tutorials	No participation in tutorials or late, OR leave early without a special consideration
Completion of tutorial exercises (70%)	Satisfactory completion all of the required exercises and tasks	Satisfactory completion most of the required exercises and tasks	Satisfactory completion a large portion of the required exercises and tasks	Satisfactory completion at least a half of portion of the required exercises and tasks	No or little work on the required exercises and tasks

2.5.2 Applied Project: (Individual) The students are required to develop an effective visualisation for relational data using existing tools or software

Weight:	30%
Type of Collaboration:	Individual
Due:	Week 8, 24/04/2020
Submission:	vUWS
Format:	Visualisation program(s) and an approximate 1000 words report.
Length:	20-25 hours
Curriculum Mode:	Report

The students are required to identify and develop effective interactive visualisation(s) for relational data using existing or new tools or software. The students are also required to write a short report on the technical contribution of the developed visualisation method as well as analysis results on the data sets.

Resources:

Check lecture notes and vUWS for hints and information

Marking Criteria:

Criteria	High Distinction	Distinction	Credit	Pass	Unsatisfactory
Develop visualisation method(s) for relational data (60%)	Produce an excellent visualisation method for presenting relational data. Full interaction is also provide in the visualisation	Produce a very good visualisation method for presenting relational data. Good interaction is also provide in the visualisation	Produce a good visualisation method for presenting relational data. Some interaction is also provide in the visualisation	Produce a satisfactory visualisation method for presenting relational data. Limited interaction is also provide in the visualisation	Not provided OR The provided method does not work according to the requirements
A short report on the technical contribution and analysis output (40%)	Produce an excellent report on the technical contribution and analysis outputs/findings ($\geq 85\%$)	Produce an very good report on the technical contribution and analysis outputs/findings (75 - 84%)	Produce a good report on the technical contribution and analysis outputs/findings (65 - 74%)	Produce a satisfactory report on the technical contribution and analysis outputs/findings (50 - 64%)	Not provided OR produce an unsatisfactory report on the technical contribution and analysis outputs/findings ($<50\%$)

2.5.3 Applied Project: (Group) The students are required to develop an effective visual analytics work for multi-dimensional data using existing tools or software.

Weight:	30%
Type of Collaboration:	Group
Due:	Week 14, 05/06/2020
Submission:	vUWS
Format:	Visual analytics work and an approximate 1000 words report.
Length:	20-25 hours
Curriculum Mode:	Report

The students are required to identify and develop effective visual analytics for analysing multi-dimensional data using existing tools or software. The students are also required to write a short report on the technical contribution of the developed visualisation method as well as analysis results on the data sets. Each group has maximum 2 students. Students in the same group will receive the same score in the normal circumstance.

Resources:

Check lecture notes and vUWS for hints and information

Marking Criteria:

Criteria	High Distinction	Distinction	Credit	Pass	Unsatisfactory
Develop visualisation method(s) for multi-dimensional data (60%)	Produce an excellent visualisation method for presenting multidimensional data. Full interaction is also provide in the visualisation	Produce a very good visualisation method for presenting multidimensional data. Good interaction is also provide in the visualisation	Produce a good visualisation method for presenting multidimensional data. Some interaction is also provide in the visualisation	Produce a satisfactory visualisation method for presenting multidimensional data. Limited interaction is also provide in the visualisation	Not provided OR The provided method does not work according to the requirements
A short report on the technical contribution and analysis output (40%)	Produce an excellent report on the technical contribution and analysis outputs/findings ($\geq 85\%$)	Produce an very good report on the technical contribution and analysis outputs/findings (75 - 84%)	Produce a good report on the technical contribution and analysis outputs/findings (65 - 74%)	Produce a satisfactory report on the technical contribution and analysis outputs/findings (50 - 64%)	Not provided OR produce an unsatisfactory report on the technical contribution and analysis outputs/findings ($<50\%$)

2.5.4 Intra-session Exam: Closed book, multiple choice

Weight:	20%
Type of Collaboration:	Individual
Due:	Week 14 at usual lecture hour
Submission:	In Class
Format:	Quiz papers
Length:	1 hour
Curriculum Mode:	Quiz

The quiz is 60 minutes closed book, held at the usual lecture at week 14. It includes multiple-choice questions covering all teaching materials from week 1 to week 13. This assessment is to be completed on an individual basis in the lecture session on your home campus.

Resources:

Check lecture notes and vUWS for hints for the quiz.

2.6 General Submission Requirements

Submission

- All assignments must be submitted by the specified due date and time.
- Complete your assignment and follow the individual assessment item instructions on how to submit. You must keep a copy of all assignments submitted for marking.

Turnitin

- The Turnitin plagiarism prevention system may be used within this unit. Turnitin is accessed via logging into vUWS for the unit. If Turnitin is being used with this unit, this means that your assignments have to be submitted through the Turnitin system. Turnitin from iParadigms is a web-based text-matching software that identifies and reports on similarities between documents. It is also widely utilised as a tool to improve academic writing skills. Turnitin compares electronically submitted papers against the following:
 - Current and archived web: Turnitin currently contains over 24 billion web pages including archived pages
 - Student papers: including Western Sydney University student submissions since 2007
 - Scholarly literature: Turnitin has partnered with leading content publishers, including library databases, text-book publishers, digital reference collections and subscription-based publications (e.g. Gale, Proquest, Emerald and Sage)
- Turnitin is used by over 30 universities in Australia and is increasingly seen as an industry standard. It is an important tool to assist students with their academic writing by promoting awareness of plagiarism. By submitting your assignment to Turnitin you will be certifying that:
 - I hold a copy of this assignment if the original is lost or damaged
 - No part of this assignment has been copied from any other student's work or from any other source except where due acknowledgement is made in the assignment
 - No part of the assignment has been written for me by any other person/s
 - I have complied with the specified word length for this assignment
 - I am aware that this work may be reproduced and submitted to plagiarism detection software programs for the purpose of detecting possible plagiarism (which may retain a copy on its database for future plagiarism checking).

Self-Plagiarising

- You are to ensure that no part of any submitted assignment for this unit or product has been submitted by yourself in another (previous or current) assessment from any unit, except where appropriately referenced, and with prior permission from the Lecturer/Tutor/Unit Co-ordinator of this unit.

Late Submission

- If you submit a late assessment, without receiving approval for an extension of time, (see next item), you will be penalised by 10% per day for up to 10 days. In other words, marks equal to 10% of the assignment's weight will be deducted from the mark awarded.
- For example, if the highest mark possible is 50, 5 marks will be deducted from your awarded mark for each late day.
- Saturday and Sunday are counted as one calendar day each.
- Assessments will not be accepted after the marked assessment task has been returned to students.
- This is consistent with Clause 51 of the Western Sydney University's Assessment Policy - Criteria and Standards-Based Assessment.

Extension of Due Date for Submission

Extensions are only granted in exceptional circumstances. To apply for an extension of time, locate an application form via the Western Sydney University homepage or copy the following link:

https://www.westernsydney.edu.au/currentstudents/current_students/forms

Application forms must be submitted to the Unit Coordinator/Convenor. Requests for extension should be made as early as possible and submitted within policy deadlines. Appropriate, supporting documentation must be submitted with the application. An application for an extension does not automatically mean that an extension will be granted. Assessments will not be accepted after the marked assessment task has been returned to students.

Resubmission

Resubmission of assessment items will not normally be granted if requested.

Application for Special Consideration

It is strongly recommended that you attend all scheduled learning activities to support your learning. If you have suffered misadventure, illness, or you have experienced exceptional circumstances that have prevented your attendance at class or your completion and submission of assessment tasks, you may need to apply for Special Consideration via the Western Sydney University website. http://www.westernsydney.edu.au/currentstudents/current_students/services_and_facilities/special_consideration2 or the Student Centre/Sydney City Campus Reception. Special Consideration is not automatically granted. It is your responsibility to ensure that any missed content has been covered. Your lecturer will give you more information on how this must be done.

3 Teaching and Learning Activities

Weeks	Topic	Lecture	Tutorial	Independent	Assessments Due
Week 1 02-03-2020	Information Visualisation - An Introduction	- Why Visualisation? - Big Data - The Challenges in Visualisation - Information Visualisation and Scientific Visualisation - Good and Bad Visualisations		Students are expected to read Lecture note and supplemented documents in vUWS.	
Week 2 09-03-2020	Human Visual Perception and Visual Design	- Perception and Cognition - Human Vision - Colour - Gestalt Laws - Visual Encoding	Tutorial 1	Students are expected to read Lecture note and supplemented documents in vUWS.	- Practical: Tutorial Labs -10 marked sessions (2% each)
Week 3 16-03-2020	Relational Data Visualisation - Part I	- Introduction to Graph Visualisation - Tree Visualisation - Connection Approach - Enclosure Approach	Tutorial 2	Students are expected to read Lecture note and supplemented documents in vUWS.	- Practical: Tutorial Labs -10 marked sessions (2% each)
Week 4 23-03-2020	Relational Data Visualisation - Part II	- Graph and Graph Visualization - Network Visualisation - Graph Tools and Applications	Tutorial 3	Students are expected to read Lecture note and supplemented documents in vUWS.	- Practical: Tutorial Labs -10 marked sessions (2% each)
Week 5 30-03-2020	Multi-dimensional Data Visualisation - Part I	- Data - Charts - Visualisation Techniques for Multi-Dimensional Data - Part I	Tutorial 4	Students are expected to read Lecture note and supplemented documents in vUWS.	- Practical: Tutorial Labs -10 marked sessions (2% each)
Week 6 06-04-2020	Multi-dimensional Data Visualisation - Part II	- Pixel Based Methods - Data Reduction - Clustering - Dimensionality Reduction - Case Studies	Tutorial 5	Students are expected to read Lecture note and supplemented documents in vUWS.	- Practical: Tutorial Labs -10 marked sessions (2% each)
Week 7 13-04-2020	Spatio-temporal Data Visualisation	- Maps - Geospatial or Geographic Visualisation (GeoVisualisations) - Discussion on GeoVisualisations	Tutorial 6	Students are expected to read Lecture note and supplemented documents in vUWS.	- Practical: Tutorial Labs -10 marked sessions (2% each)
Week 8 20-04-2020	Interaction	- Interaction - Navigation Techniques - Environments	Tutorial 7	Students are expected to read Lecture note and supplemented documents in vUWS. This tutorial is not marked.	- Applied Project: (Individual) The students are required to develop an effective visualisation for relational data using existing tools or software
Week 9 27-04-2020	Break				

Weeks	Topic	Lecture	Tutorial	Independent	Assessments Due
Week 10 04-05-2020	Visual Analytics	- Visual Analytics Background - Disciplines - Visual Analytics Systems for Big Data - Predictive Tools for Big Data	Tutorial 8	Students are expected to read Lecture note and supplemented documents in vUWS.	- Practical: Tutorial Labs -10 marked sessions (2% each)
Week 11 11-05-2020	Using Visualisation and Tools to Analyse Data - Part I	- TabuVis - Getting Start with Tableau	Tutorial 9	Students are expected to read Lecture note and supplemented documents in vUWS.	- Practical: Tutorial Labs -10 marked sessions (2% each)
Week 12 18-05-2020	Using Visualisation and Tools to Analyse Data - Part II	- Visual Analytics with Tableau - Part I	Tutorial 10	Students are expected to read Lecture note and supplemented documents in vUWS.	- Practical: Tutorial Labs -10 marked sessions (2% each)
Week 13 25-05-2020	Using Visualisation and Tools to Analyse Data - Part III	- Visual Analytics with Tableau - Part II	Tutorial 11	Students are expected to read Lecture note and supplemented documents in vUWS.	- Practical: Tutorial Labs -10 marked sessions (2% each)
Week 14 01-06-2020	Final Semester Quiz	Quiz	Tutorial 12	Students are expected to read Lecture note and supplemented documents in vUWS. This tutorial is not marked.	- Applied Project: (Group) The students are required to develop an effective visual analytics work for multi-dimensional data using existing tools or software. - Intra-session Exam: Closed book, multiple choice
Week 15 08-06-2020	Stuvac				
Week 16 15-06-2020	Formal Examination Period				
Week 17 22-06-2020	Formal Examination Period				

The above timetable should be used as a guide only, as it is subject to change. Students will be advised of any changes as they become known on the unit's vUWS site.

4 Learning Resources

4.1 Recommended Readings

Essential Reading

Cao, M., Segall, R., & Zhang, Q. (Eds.). (2011). Visual analytics and interactive technologies : data, text, and web mining applications. Hershey, PA: Information Science Reference.

Jones, B. (2014). Communicating data with tableau (1st ed.). Sebastopol, CA: O'Reilly Media.

Spence, R. a. (2014). Information visualization : an introduction (3rd ed.). New York: Springer.

Thomas, J. J., & Cook, K. A. (2005). Illuminating the Path: The research and development agenda for visual analytics. from http://vis.pnnl.gov/pdf/RD_Agenda_VisualAnalytics.pdf

Ward, M., Grinstein, G. G., & Keim, D. (2010). Interactive data visualization : foundations, techniques, and applications. Natick, Mass.: A K Peters.

Additional Reading

Card, S. K., Mackinlay, J. D., & Shneiderman, B. (1999). Readings in information visualization: using vision to think.: Morgan Kaufmann.

Chen, C. (2006). Information visualization beyond the horizon (2nd ed.). London: Springer-Verlag London Limited.

Dill, J. (Ed.). (2012). Expanding the frontiers of visual analytics and visualization. London; New York: Springer.

Gilbert, J., Reiner, M., & Nakhleh, M. B. (Eds.). (2008). Visualization theory and practice in science education. New York: Springer.

Hansen, C. D., & Johnson, C. R. (2011). Visualization Handbook. Burlington: Elsevier Science.

Jacko, J. A. (Ed.). (2012). The human-computer interaction handbook : fundamentals, evolving technologies, and emerging applications (3rd ed.). Boca Raton, FL: CRC Press.

Keller, T., & Tergan, S.-O. (2005). Knowledge and Information Visualization Searching for Synergies. Berlin Heidelberg: Springer-Verlag GmbH.

Marakas, G. M. (2003). Modern data warehousing, mining, and visualization : core concepts. Upper Saddle River, N.J.: Prentice Hall.

McDaniel, S., & McDaniel, E. (2013). Rapid Graphs with Tableau 8 The Original Guide for the Accidental Analyst (4th ed.). Berkeley, CA: Apress.

Meirelles, I. (2013). Design for Information : An Introduction to the Histories, Theories, and Best Practices Behind Effective Information Visualizations. Beverly, MA: Rockport Publishers.

Munzner, T. (2014). Visualization Analysis and Design. Hoboken: Taylor and Francis.

Murray, D. (2013). Tableau your data! : fast and easy visual analysis with tableau software. Indianapolis, Indiana: Wiley.

Murray, S. C. (2013). Interactive Data Visualization for the Web. Sebastopol, CA: O'Reilly Media, Inc.

Peck G. (2016). Tableau 9 - The Official Guide. Mc Graw Hill Education.

- Preim, B., & Botha, C. P. (2013). Visual Computing for Medicine Theory, Algorithms, and Applications (2nd ed.). Burlington: Elsevier Science.
- Ware, C. (2010). Visual Thinking for Design for Design. Burlington: Elsevier Science.
- Ware, C. (2012). Information Visualization Perception for Design (3rd ed.). Burlington: Elsevier Science.
- Zhu, N. Q. (2013). Data visualization with D3.js cookbook. Birmingham Packt Publishing.