

# Assessment Cover Sheet

## Institute of Information & Communication Technology

|  |  |                                |                    |
|--|--|--------------------------------|--------------------|
| <b>Course Title</b>  | B.Sc. (Hons.) Software Development / Multi-media Software Development/ Computer Systems & Networking | <b>Unit Number &amp; Title</b> | IICT6009 - Project |
| <b>Lecturer</b>  | Mr. Frankie Inguanez<br>Mr. Chris Farrugia   | <b>Assignment Title</b>        | Project            |
| <b>Verified by</b>   |  | <b>Date</b>                    |                    |
| <b>Date Set</b>  | 6/02/2017  | <b>Deadline Date</b>           | 02/06/2017         |
| <b>Class/group</b>   |  | <b>Academic Year</b>           | 2016/2017          |
| <b>Student Name</b>  |  | <b>ID Number</b>               |                    |
| <b>Student's declaration prior to hand-in</b><br>I certify that the work submitted for this assignment is my own; and that I have read and understood MCAST/the College's copying and plagiarism policy.   |  |                                |                    |
| <b>Student's declaration on assessment special arrangements: LEAVE BLANK IF NOT APPLICABLE</b><br><br>I certify that adequate support was given to me during the assignment through the Institute and/or the Inclusive Education Unit.<br><br>I declare that I refused the special support offered by the Institute. |  |                                |                    |
| <b>Student Signature:</b>  |  | <b>Date :</b>                  |                    |

| Assessment Parameters        | Max Mark   | Marks Achieved |
|------------------------------|------------|----------------|
| <b>Total Assignment Mark</b> | <b>100</b> |                |

| Feedback           |  |      |  |
|--------------------|--|------|--|
|                    |  |      |  |
| Learner signature  |  | Date |  |
| Assessor signature |  | Date |  |
| Internal Verifier  |  | Date |  |

| Verifier Comments  |  |      |  |
|--------------------|--|------|--|
|                    |  |      |  |
| Verifier Name      |  | Date |  |
| Verifier Signature |  |      |  |

## B.Sc. (Hons.) 2<sup>nd</sup> Year Project

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February, 2017

### 1 AIM & OBJECTIVES

The main aim of this project is to prepare the learner for their dissertation research project.

1. **Document** the various aspects of a project
2. **Implement** a prototype as proof of concept
3. Gather & **analyse** data to evaluate and form an opinion
4. Prepare the initial draft of the dissertation research **proposal**.

### 2 PROJECT IDEAS

A number of project ideas are being presented to you, these are general ideas aimed at guiding you towards what a project should be.

### 3 SCHEDULE

In the third week of the semester an initial proposal shall be presented by each student during an interview with the lecturer. During the semester a minimum of two review meetings shall be held where feedback shall be provided for the work done to date. Submission of project together with the dissertation proposal shall be done 2 weeks prior end of semester, after which VIVA presentations shall be held. A schedule of the entire project is being provided in Table. 3.1.

| #  | Week  | Topic/Task                                    |
|----|---|---|
| 01 | 12 <sup>th</sup> -17 <sup>th</sup> February       | Issuing of brief, discussion of project ideas |
| 02 | 19 <sup>th</sup> -24 <sup>th</sup> February       | Stream Specific Topic 01                      |
| 03 | 26 <sup>th</sup> February - 3 <sup>rd</sup> March | Proposal Presentations                        |
| 04 | 6 <sup>th</sup> -10 <sup>th</sup> March           | Stream Specific Topic 02                      |
| 05 | 13 <sup>th</sup> -17 <sup>th</sup> March          | Working on Projects                           |
| 06 | 20 <sup>th</sup> -24 <sup>th</sup> March          | 1st Review Meeting                            |
| 07 | 27 <sup>th</sup> -31 <sup>st</sup> March          | 1st Review Meeting                            |
| 08 | 3 <sup>rd</sup> -7 <sup>th</sup> April            | Working on Projects                           |
| 09 | 10 <sup>th</sup> -14 <sup>th</sup> April          | Working on Projects                           |
| 10 | 17 <sup>th</sup> -21 <sup>st</sup> April          | Easter Recess                                 |
| 11 | 24 <sup>th</sup> -28 <sup>th</sup> April          | Stream Specific Topic 03                      |
| 12 | 1 <sup>st</sup> -5 <sup>th</sup> May              | 2nd Review Meeting                            |
| 13 | 8 <sup>th</sup> -12 <sup>th</sup> May             | 2nd Review Meeting                            |
| 14 | 15 <sup>th</sup> -19 <sup>th</sup> May            | Working on Projects                           |
| 15 | 22 <sup>nd</sup> -26 <sup>th</sup> May            | Working on Projects                           |
| 16 | 29 <sup>th</sup> May - 2 <sup>nd</sup> June       | Project submissions                           |
| 17 | 5 <sup>th</sup> -9 <sup>th</sup> June             | VIVA Presentations                            |
| 18 | 12 <sup>th</sup> -16 <sup>th</sup> June           | VIVA Presentations                            |
| 19 | 19 <sup>th</sup> -23 <sup>rd</sup> June           | Issuing of results                            |

Table 3.1: Module Schedule

## 4 LOGBOOK

You are required to maintain a logbook of your progress. This shall take the form of a GIT repository, for which you can use <https://BitBucket.org> or <https://GitHub.com>. Ensure that you share it with your lecturer. You can use an application such as SourceTree as a git client. Ensure that you commit your work throughout the project (at least once a month) since the commit history will be the actual logbook. The repository should contain the following folder structure:

- **ini** - The initial proposal and related documents.
- **lit** - All literature used.
- **src** - The source to your prototype (do not include Virtual Machines if any used).
- **dat** - All data gathered for analysis.
- **doc** - Final documentation with presentation.
- **pro** - The dissertation proposal using the official document.

**N.B.** You are free to use any structure of your choice within the above mentioned folders, yet the above structure should be unchanged in your root folder.

## 5 DELIVERABLES

### 5.1 INITIAL PROPOSAL

For your initial proposal you are to fill-in the appropriate form and present it in a short interview, during which your idea will be discussed together with your lecturer.

1. The research question
2. The aim & main objectives (only 4)
3. The rationale
4. Current research/alternatives
5. The desired end product
6. The expected benefits/challenges
7. Timeframe/Project Plan/Methodology
8. Research method

### 5.2 PROJECT DOCUMENTATION

An IEEE-styled paper (5-7 pages excluding references) documenting the project. You should include at least 5 references (2 if documenting an internship project) and be concise in your writing. You are to use  $\LaTeX$  to write this document using an IEEE template.

1. Title (including full name, university details and personal university email address)
2. Abstract (approx. 100 word brief on research)
3. Keywords (around 4 terms related to research and techniques used)
4. Introduction (aim, objectives, motivation and relevance of research)
5. Literature Review / alternatives / competition (current research and related projects)
6. Research Methodology (Approach adopted)
7. Findings and Results (observations and data obtained)
8. Discussion of Results (interpretation of gathered data and observations made)
9. Conclusion (assessment on project outcome and recommendations for future)

### 5.3 DISSERTATION PROPOSAL

An initial draft of the official dissertation proposal to be submitted on TurnItIn together with the report (as an appendix).

#### 5.4 PROTOTYPE

At the end of your project, you should have a working prototype/proof-of-concept for which you must present the following:

1. An executable/runnable with clear usage instructions.
2. A link to a 2-5 minutes YouTube (or equivalent) video link demonstrating complete use.
3. Accompanying code.

#### 5.5 VIVA PRESENTATION

For your VIVA you are to prepare a 10 minute presentation with the following:

1. Title Page
2. Research question / aim with objectives
3. Rationale / motivation
4. Literature review
5. Research methodology / approach (screenshots/illustrations)
6. Findings & results (data gathered without interpretation)
7. Analysis of results (interpretation of results)
8. Conclusion / lessons learnt & recommendations for future research

**N.B.** You are not limited to creating a slideshow, you can prepare a background video or use other kinds of media.

**N.B.** You will be asked to demonstrate the working prototype followed by some questions, this can be done using a pre-recorded video to fit into the time restrictions.

**N.B.** A casual smart dress code is requested for this presentation.

| <b>Project Criteria 01</b>   | <b>Mark</b>    |
|--|----------------|
| <b>AA1.1</b> Logbook<br>Setup a GIT repository, commit & push your work regularly (once a month).<br>Share with your lecturer and present work during review meetings.                         | _ / 7          |
| <b>KU1.2</b> Aim & Objectives<br>Provide a research question and 4 main objectives.<br>Present in your proposal pitch and introduction.  | _ / 5          |
| <b>KU1.3</b> Methodology<br>Identify a project methodology and apply to your project.<br>Present in your proposal pitch and research methodology.  | _ / 5          |
| <b>KU1.4</b> Project Plan<br>Document a project plan illustrating each stage of your project.<br>Present in your proposal pitch and research methodology.                                      | _ / 5          |
| <b>KU1.5</b> Initial Proposal Pitch<br>Present your project proposal in an interview.  | _ / 5          |
| <b>KU1.1</b> Literature Review<br>Undertake a literature review using at least 5 research papers.  | _ / 5          |
| <b>KU2.1</b> Proof of concept<br>Implement a prototype as a proof of concept of your research.<br>Document the prototype in your research methodology and VIVA.                                | _ / 5          |
| <b>AA2.2</b> Analysis of prototype<br>Implement techniques to analyse your prototype.<br>Document the techniques in your research methodology and VIVA.  | _ / 7          |
| <b>AA2.1</b> Data Analysis<br>Develop an artefact to assess your research question.<br>Document in your research methodology, data in the findings and results section, then all in your VIVA. | _ / 7          |
| <b>KU1.6</b> Hypothesis testing<br>Create a number of tests to demonstrate positive/negative results.<br>Document in the findings and results section and VIVA.                                | _ / 5          |
| <b>SE3.1</b> Project evaluation<br>Assess the project and propose improvements.<br>Document in the discussion of results section, and VIVA.  | _ / 10         |
| <b>AA3.1</b> Research analysis<br>Prepare an analysis of how you achieved the research aim<br>Document in the discussion of results section, and VIVA.   | _ / 7          |
| <b>AA3.2</b> Future research<br>Propose extensions of this research with a revised hypothesis.<br>Document in your conclusion and recommendations section, and VIVA.                           | _ / 7          |
| <b>SE4.1</b> Dissertation Proposal<br>Prepare a dissertation proposal based on the assessment of this project.<br>Present this document during your VIVA.                                      | _ / 10         |
| <b>SE4.2</b> Academic Report<br>Style and reference your report using the IEEE template in a $\LaTeX$ application.   | _ / 10         |
| <b>Total</b>   | <b>_ / 100</b> |

| <b>Internship Criteria</b>   | <b>Mark</b> |
|--|-------------|
| <b>AA1.1</b> Logbook<br>Maintain a log of all your work at internship (projects, tasks, duration).<br>Present this log in your VIVA  | _ / 7       |
| <b>KU1.1</b> Literature Review<br>Undertake a literature review using at least 2 research papers<br>Gather information about a project within the company related to your research project.<br>Document in your literature review. | _ / 5       |
| <b>KU1.3</b> Methodology<br>Document the methodology adopted and persons involved for the documented project.<br>Document in your literature review.   | _ / 5       |
| <b>KU1.4</b> Project Plan<br>Document the lifecycle of the project, the deadlines adopted and if they were met.<br>Document in your literature review.   | _ / 5       |
| <b>KU1.6</b> Hypothesis testing<br>Document QA/Testing procedures adopted in this project.<br>Document the data gathered in the findings and results section.  | _ / 5       |



# B.Sc. (Hons.) 2<sup>nd</sup> Year Project - Project Ideas

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February, 2017

## 1 DATA SCRAPER

The general idea here is to create an application that will retrieve data from a 3rd party, then perform an ETL process to obtain the necessary information. Data from different sources but of the same subject should be linked, then some analysis will be done on the accuracy of the prototype.

### 1.1 SUGGESTED PROJECT

Create an application that will scrape the news articles from two sources such as CNN and BBC or Times Of Malta and The Malta Independent. This can be done via an RSS feed using XML or an API using JSON, alternatively a raw HTTP request and process the HTML response. Then, extract the necessary information, clean and store in a DB. Generate some statistics, such as term frequency, or weighted score (such as title text, sub-title text). Offer an interface to have articles linked (at this stage this can be done manually, but in your dissertation this will be done automatically) then an aggregate entry would be displayed, which when selected the links to the different sources are made available and a gallery with all media is shown. Finally, prepare some analysis on the gathered data and approach taken.

### 1.2 SOURCES

The following are some sources of inspiration:

- Google News <http://news.google.com>
- Feedly <http://feedly.com/i/welcome>

### 1.3 VARIATIONS/IMPROVEMENTS

The following are possible variations and/or improvements of the suggested project:

- Scraping of betting odds / comments
- Scraping of articles in two different languages
- Analysis of fluctuations of odds for a specific period
- Analysis of peak times of comment writing
- A visualisation of how a specific topic, such as terrorism, spread over time in a specific geographic area.
- Create a mobile app with a subscription concept to personalise entries to be displayed



Figure 1.1: News Scraper

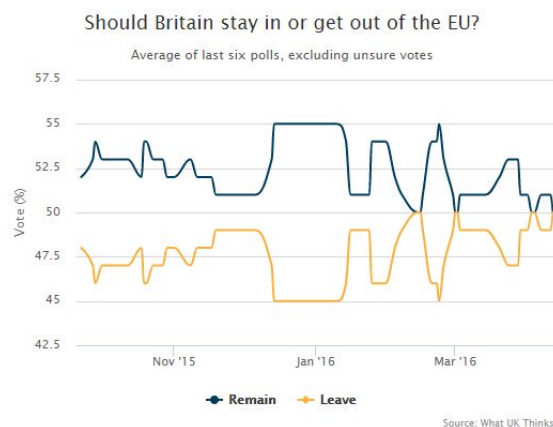


Figure 1.2: Odds fluctuations

## 2 ACTION HIGHLIGHT

The idea is to create an application that will take a photo or record a video at the moment of a highlight. This can be done by the pairing of other devices such as a subject smartphone, heart rate monitor or smart watch/band. After a number of attempts identify the thresholds needed to take the perfect highlight.

### 2.1 SUGGESTED PROJECT

Create an application that is capable of taking a jump photo at the perfect moment, when the subject is at the highest point of their jump. This can be done by developing a mobile application with two modes. First, the photographer enters the photo mode, where the device activates the camera and awaits for a signal from a second paired device. The jumper would also have a smartphone with the same app and is paired with the photographer. The jumper would enter jump mode, where the app makes use of the accelerometer to detect a sudden spike in acceleration, which would then send a signal to the photographer app that will take a photo after a short delay. The research aspect would involve taking multiple attempts to identify the acceleration threshold and photo delay timings. An analysis of the accuracy level would follow.

### 2.2 SOURCES

The following are some sources of inspiration:

- Paper <https://graphics.ethz.ch/publications/papers/paperLanc14a.php>
- Jumps <https://www.youtube.com/watch?v=TzVm8anwV5I>

### 2.3 VARIATIONS/IMPROVEMENTS

The following are possible variations and/or improvements of the suggested project:

- Have a subject wear a heart rate monitor and the mobile app would record a video when the heart rate spikes
- Process a video of a game, such as football, and identify highlights based on sound levels or other techniques

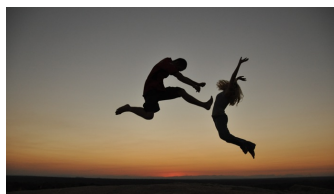


Figure 2.1: Jump Photo

### 3 GAME APP

The general idea here is to create a never ending game where the player controls a character and has to avoid a number of obstacles whilst gathering points when successful, getting penalties when failing. In your dissertation, this can be evolved to a multi-level playing game.

#### 3.1 SUGGESTED PROJECT

Create an infinity game similar, to flappy birds, with graphics for background, foreground, character, obstacles and menu items. Design a simple menu to start a game and view top scores. Set a point and penalty system and the rules of your game. Require user registration upon completion of a game and achieving a top score. Have some persons play the game and gather feedback, also gather statistics about your project, such as memory usage, file sizes and more. Provide an assessment on how application can be improved.

#### 3.2 SOURCES

The following are some sources of inspiration:

- Flappy Bird
- Temple Run

#### 3.3 VARIATIONS/IMPROVEMENTS

The following are possible variations and/or improvements of the suggested project:

- 3D layout
- Use of gyroscope
- User ranking/level up



Figure 3.1: Infinity Game

## 4 NON-PLAYER CHARACTER (NPC)

Develop an application that can play a game such as solitaire, poker or sudoku. You can chose any already existing game on an OS of your choice, or even web based games and develop an application that simulates mouse clicks or HTTP requests to play the game. You are not to develop the game itself but rather to play it.

### 4.1 SUGGESTED PROJECT

Create an application that navigates to a Sudoku online web page, scrap the information, and solve it. Submit the solution and process feedback response.

### 4.2 SOURCES

The following are some sources of inspiration:

- Sudoku <http://mypuzzle.org/sudoku>
- Solitaire <https://www.solitr.com/>

### 4.3 VARIATIONS/IMPROVEMENTS

The following are possible variations and/or improvements of the suggested project:

- Human delay simulation
- Game assistant such as Minecraft Assistant

|   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|
|   |   |   | 7 |   |   | 4 |   | 5 |
| 7 |   |   |   | 4 |   | 1 | 6 |   |
| 1 |   |   |   | 8 |   |   | 3 | 2 |
|   | 1 | 8 | 4 | 5 |   |   |   |   |
| 3 |   | 5 | 8 |   | 7 | 2 |   | 1 |
|   |   |   |   | 6 | 3 | 8 | 5 |   |
| 8 | 7 |   |   | 2 |   |   |   | 6 |
|   | 3 | 1 |   | 7 |   |   |   | 4 |
| 4 |   | 6 |   |   | 5 |   |   |   |

Figure 4.1: Game Bot

## 5 DATA MINING

Get hold of an existing data set and identify the problem that needs to be solved. Research different data mining or artificial intelligence techniques and attempt a solution.

### 5.1 SUGGESTED PROJECT

Get hold of the KDDCup 99 data set which is an extensive web log of network traffic that contains a log of hacking attempts. Develop a simple artificial neural network that classifies normal web traffic from an intrusion attempt. Analyse the effectiveness of your prototype by plotting a confusion matrix.

### 5.2 SOURCES

The following are some sources of inspiration:

- KDD Cup 1999 <https://kdd.ics.uci.edu/databases/kddcup99/kddcup99.html>
- LISA <http://cvrr.ucsd.edu/LISA/datasets.html>

### 5.3 VARIATIONS/IMPROVEMENTS

The following are possible variations and/or improvements of the suggested project:

- Perform a model selection exercise
- Perform cross-validation techniques
- Do a collaborative filtering prototype (recommender system)
- Visualisation of existing data set

|  |           | Actual Value<br>(as confirmed by experiment) |                                |
|--|-----------|--|--------------------------------|
|  |           | positives                                    | negatives                      |
| Predicted Value<br>(predicted by the test) | positives | <b>TP</b><br>True<br>Positive                | <b>FP</b><br>False<br>Positive |
|  | negatives | <b>FN</b><br>False<br>Negative               | <b>TN</b><br>True<br>Negative  |

Figure 5.1: Confusion Matrix

## 6 AUGMENTED REALITY

Develop a prototype that is able to process an image of a specific target such as facial recognition for automated attendance, traffic assistance, augmented reality for museum artefacts, augmented reality for tagging of persons, speech bubble display for deaf persons.

### 6.1 SUGGESTED PROJECT

Prosopagnosia (face blindness), is the inability to recognise faces, not even your own. Using your smartphone, take a number of photos or videos of a number of persons, sometimes just 1 person, in others with multiple individuals. Develop a small application that is capable of identifying faces. Run a facial recognition software that returns the name of the recognised person. Display a name tag under/over the recognised individual's face.

### 6.2 SOURCES

The following are some sources of inspiration:

- Face Detector <https://developers.google.com/vision/android/face-tracker-tutorial/>
- Heritage App <http://heritageapp.be/>

### 6.3 VARIATIONS/IMPROVEMENTS

The following are possible variations and/or improvements of the suggested project:

- Enhance a museum experience
- Display speech bubble with spoken text
- Driving assistance

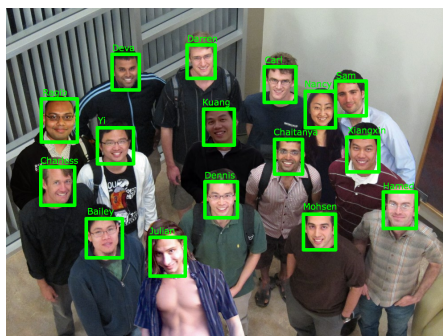


Figure 6.1: Augmented Reality

## 7 INDOOR WI-FI BASED POSITIONING SYSTEM

Various applications require the identification of a device/person within an environment. The most common positioning technology is GPS which has proven to be extremely useful for various applications such as navigation. The problem with GPS is that it does not work indoors due to poor GPS reception.

An indoor positioning system can be extremely effective for applications such as asset tracking, occupancy detection and automation.

Over the years various research publications tackled this problem and various proposals came forward. Due to the fact that nowadays, most environments have WIFI coverage, there were various projects that used an existing WIFI network for indoor positioning.

### 7.1 SUGGESTED PROJECT

Design and implement a simple WIFI based indoor positioning system. You will be using a dedicated wireless network provided by the institute.

### 7.2 SOURCES

The following are some sources of inspiration:

- MIT turns Wi-Fi Into Indoor GPS <http://spectrum.ieee.org/tech-talk/telecom/wireless/mit-turns-wifi-into-indoor-gps>
- A comparative analysis of Indoor WiFi Positioning at a large building complex <http://ieeexplore.ieee.org/document/7743666/>
- Indoor WiFi positioning system for Android-based smartphone <http://ieeexplore.ieee.org/document/5674691/>
- A hybrid indoor positioning algorithm based on WiFi fingerprinting and pedestrian dead reckoning <http://ieeexplore.ieee.org/document/7794982/>
- How Feasible Is WiFi Fingerprint-Based Indoor Positioning for In-Home Monitoring? <http://ieeexplore.ieee.org/document/7723472/>



## 8 NAT TRAVERSAL FOR P2P

Peer-to-Peer (P2P) communication is used in a variety of applications. One of the main disadvantages of P2P applications is the setup required at infrastructure level. Since internal networks are always hidden behind NAT, port forwarding needs to be set up for P2P communication to take place.

To overcome this disadvantage, a number of techniques have been developed. One of the most common techniques is UDP holepunching. This enables two users to communicate from behind their NATs without the need for any port forwarding.

### 8.1 SUGGESTED PROJECT

Design and develop a simple P2P application along with the necessary infrastructure to enable communication between two or more instances of the same application without requiring any modifications to the network firewall's configuration.

### 8.2 SOURCES

The following are some sources of inspiration:

- On NAT Traversal in Peer-to-Peer Applications <http://ieeexplore.ieee.org/document/4806906/>
- Overcoming NAT traversal issue for SIP-based communication in P2P networks <http://ieeexplore.ieee.org/document/6097262/>
- Combining STUN Protocol and UDP Hole Punching Technique for Peer-To Peer Communication across Network Address Translation <http://ieeexplore.ieee.org/document/7021753/>

## 9 MULTICAST FILE TRANSFER

Unicast, Multicast and Broadcast are the main modes of data transmission over a computer network. Multicasting is used when data needs to be sent from one node to a subset of the other nodes on a network. The advantage of multicasting is that the transmission capacity of the sender is not split between the receivers.

When a large file needs to be transmitted over a network, system administrators typically host the file on a server and download it using a unicast connection on the network devices. This process is inefficient in various aspects.

### 9.1 SUGGESTED PROJECT

Investigate how one can take advantage of multicasting to transfer files over a computer network. The artefact for this project will be scripts that can make this transfer possible.

### 9.2 SOURCES

The following are some sources of inspiration:

- UFTP-Multicast <http://uftp-multicast.sourceforge.net/>
- Scalable and Reliable Multicast File Transfer Architecture [https://www.isoc.org/inet99/proceedings/4b/4b\\_1.htm](https://www.isoc.org/inet99/proceedings/4b/4b_1.htm)
- IP Multicast Technology Overview [http://www.cisco.com/c/en/us/td/docs/ios/solutions\\_docs/ip\\_multicast/White\\_papers/mcst\\_ovr.html](http://www.cisco.com/c/en/us/td/docs/ios/solutions_docs/ip_multicast/White_papers/mcst_ovr.html)

## 10 NETWORK TRAFFIC ANALYSIS

An essential duty of a systems administrator is monitoring the network to ensure its proper operation. As networks get complex and extremely active, it can be quite difficult to gain proper insight.

In computer science and artificial intelligence, the area of data mining deals with extracting characteristics and patterns from very large data sets. Over the years, there was a lot of research on the application of data mining techniques for extracting of patterns/information from network traffic captures.

### 10.1 SUGGESTED PROJECT

Design and develop an script that applies simple data mining techniques to a selected network traffic dataset.

### 10.2 SOURCES

The following are some sources of inspiration:

- Centre for Applied Internet Data Analysis <http://www.caida.org/data/overview/>
- Publicly available PCAP files <http://www.netresec.com/?page=PcapFiles>
- Data mining meets network analysis: Traffic prediction models <http://ieeexplore.ieee.org/document/6859800/>
- Data mining based wireless network traffic forecasting <http://ieeexplore.ieee.org/document/6408051/>