Student Unit Enrolment Pathway Predictions – Understanding the "New Normal"

Presenters: Shane Griffin, Pushkar Kadam, Vivek Dafre and Chris Wang
Chair: Vicky Gravolin

Presentations will be made available on the Conference website for your reference.

THIS ZOOM MEETING IS BEING RECORDED Western Sydney University will record this Zoom meeting for publishing on its website. As attendees, the transmission of your video and audio during the Zoom meeting is completely optional. If you do participate, your video and audio transmission will be automatically captured by the recording in addition to being accessible to other participants of the Zoom meeting.

Participation in the 'Chat', 'Question and Answer' and/or 'Poll' sections of the Zoom meeting is completely optional. By participating in the Chat you consent to the information shared in these sections being collected and used by Western Sydney University for learning purposes and to build a catalogue of 'Frequently Asked Questions' for the benefit of other prospective students.

Any personal information collected by Western Sydney University during the Zoom meeting will be handled in accordance with its *Privacy Policy* and *Privacy Management Plan* which can be accessed online at https://www.westernsydney.edu.au/policy/policy_dds

WESTERN
OUR NEW NORMAL

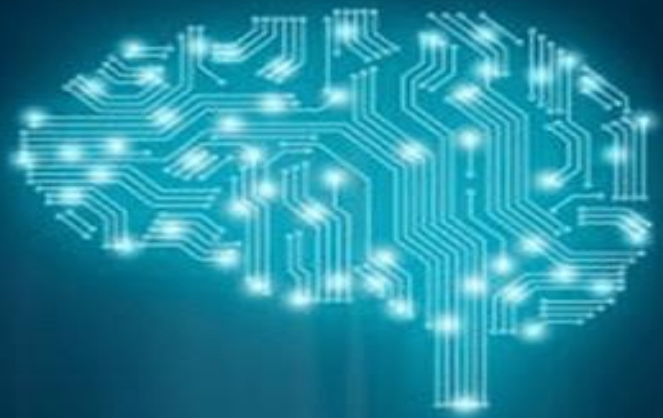
Student Unit Enrolment Pathway Predictions

How to Better Understand the ‘New Normal’

WESTERN
OUR NEW NORMAL

The Problem

- We do not currently have an accurate way to predict student unit enrolment pathways



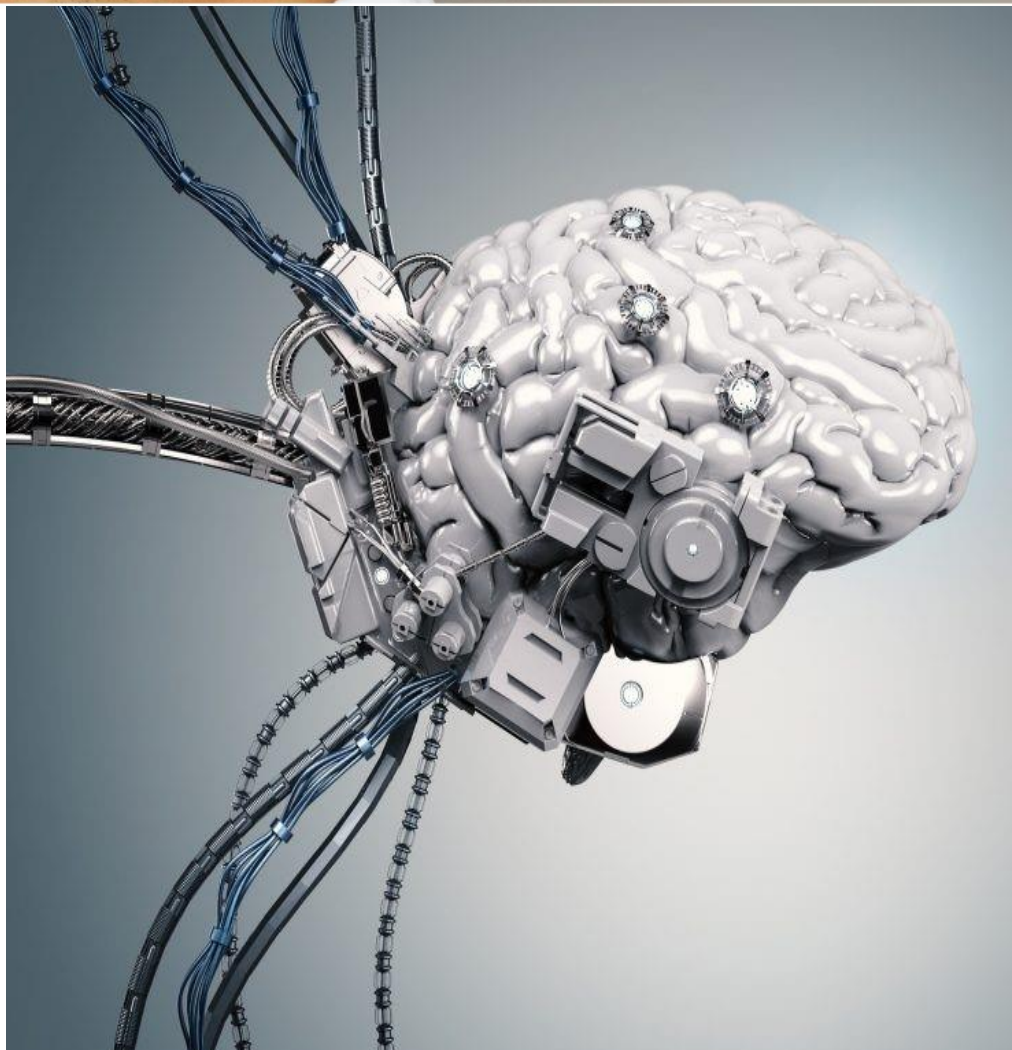
Why is this an issue?

- The choices the students make has a direct impact on the timetable & therefore the workloads of teaching & support staff.

WESTERN
OUR NEW NORMAL

Why so complicated?

- At WSU many programs allow students a wide range of unit choices.
- The number of possible choices combined with large numbers of students creates a very large number of possible pathways.
- Understanding the probability of a student taking a pathway & how that effects unit enrolments requires deeper analysis.
- How can we better predict student movements especially in post COVID new normal?



Project approach

WESTERN SYDNEY UNIVERSITY

01. STEP

Data Collection & cleaning

02. STEP

Challenges of handling Big Data Handling & Processing

03. STEP

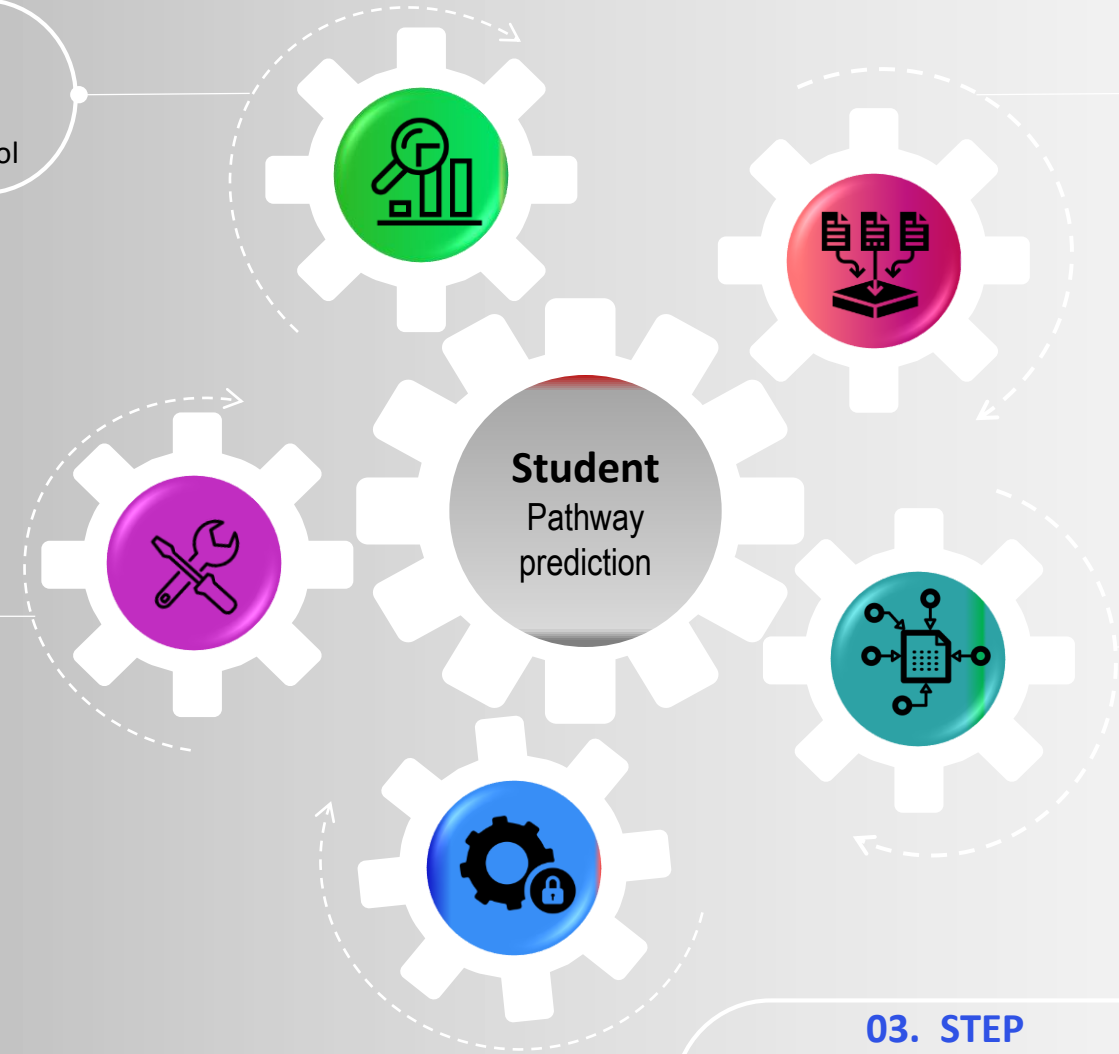
Data security & confidentiality – Student ID encryption

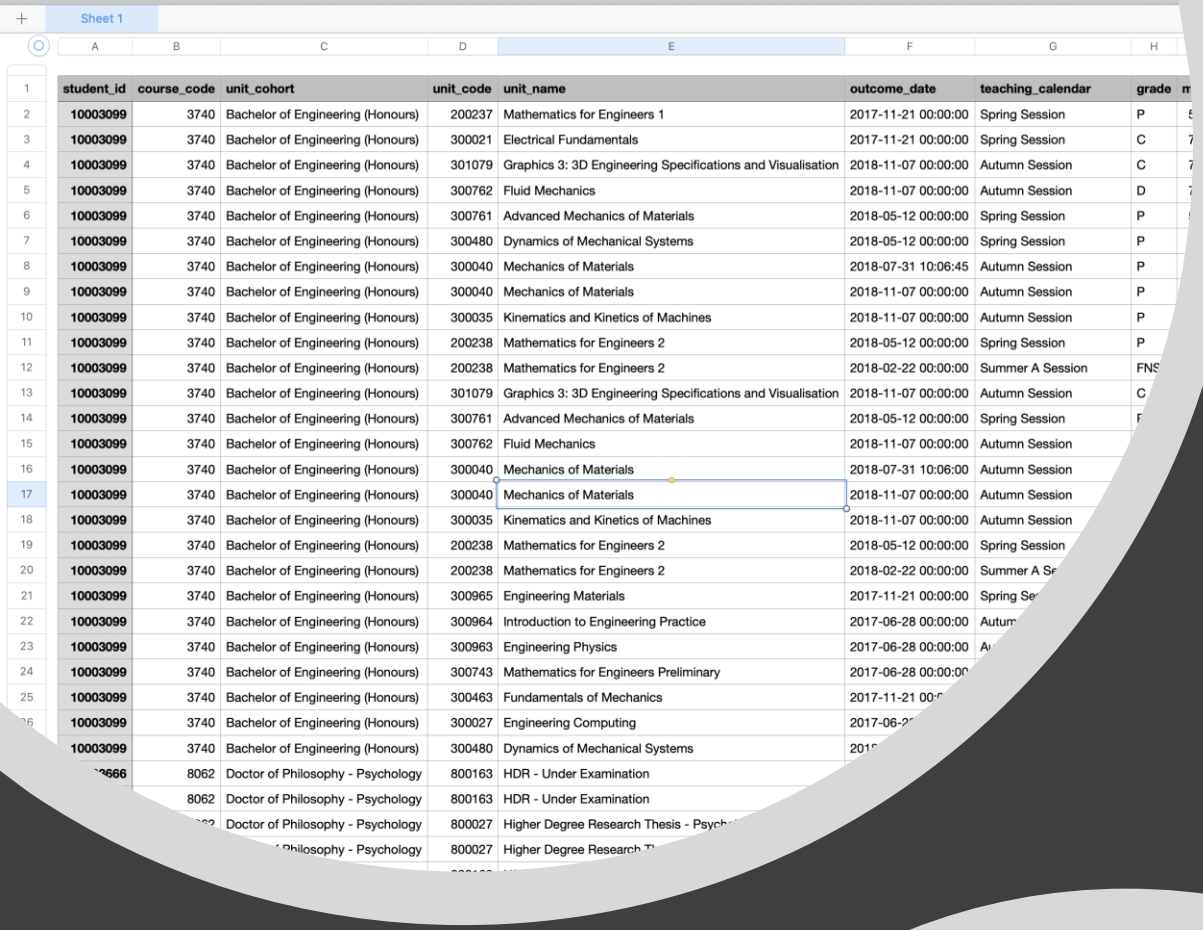
04. STEP

Methods & Tools for Data modelling– Python, Network diagram & Machine Learning

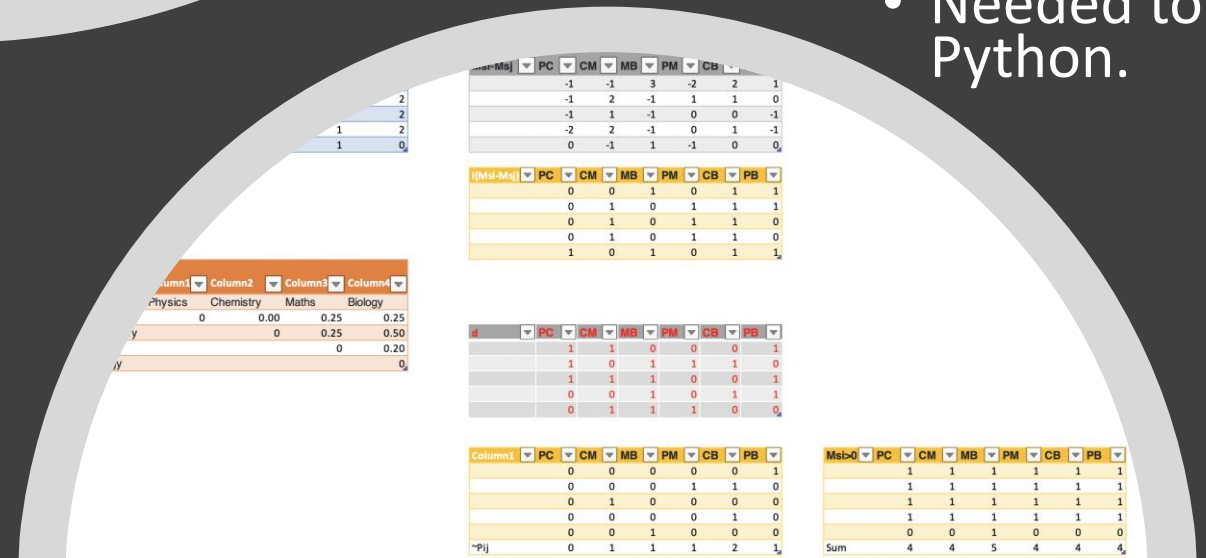
05. STEP

Analyse Test results – Actual Vs prediction
Identify best prediction model/ Tool




Sheet 1

student_id	course_code	unit_cohort	unit_code	unit_name	outcome_date	teaching_calendar	grade
10003099	3740	Bachelor of Engineering (Honours)	200237	Mathematics for Engineers 1	2017-11-21 00:00:00	Spring Session	P
10003099	3740	Bachelor of Engineering (Honours)	300021	Electrical Fundamentals	2017-11-21 00:00:00	Spring Session	C
10003099	3740	Bachelor of Engineering (Honours)	301079	Graphics 3: 3D Engineering Specifications and Visualisation	2018-11-07 00:00:00	Autumn Session	C
10003099	3740	Bachelor of Engineering (Honours)	300762	Fluid Mechanics	2018-11-07 00:00:00	Autumn Session	D
10003099	3740	Bachelor of Engineering (Honours)	300761	Advanced Mechanics of Materials	2018-05-12 00:00:00	Spring Session	P
10003099	3740	Bachelor of Engineering (Honours)	300480	Dynamics of Mechanical Systems	2018-05-12 00:00:00	Spring Session	P
10003099	3740	Bachelor of Engineering (Honours)	300040	Mechanics of Materials	2018-07-31 10:06:45	Autumn Session	P
10003099	3740	Bachelor of Engineering (Honours)	300040	Mechanics of Materials	2018-11-07 00:00:00	Autumn Session	P
10003099	3740	Bachelor of Engineering (Honours)	300035	Kinematics and Kinetics of Machines	2018-11-07 00:00:00	Autumn Session	P
10003099	3740	Bachelor of Engineering (Honours)	200238	Mathematics for Engineers 2	2018-05-12 00:00:00	Spring Session	P
10003099	3740	Bachelor of Engineering (Honours)	200238	Mathematics for Engineers 2	2018-02-22 00:00:00	Summer A Session	FNS
10003099	3740	Bachelor of Engineering (Honours)	301079	Graphics 3: 3D Engineering Specifications and Visualisation	2018-11-07 00:00:00	Autumn Session	C
10003099	3740	Bachelor of Engineering (Honours)	300761	Advanced Mechanics of Materials	2018-05-12 00:00:00	Spring Session	P
10003099	3740	Bachelor of Engineering (Honours)	300762	Fluid Mechanics	2018-11-07 00:00:00	Autumn Session	
10003099	3740	Bachelor of Engineering (Honours)	300040	Mechanics of Materials	2018-07-31 10:06:00	Autumn Session	
10003099	3740	Bachelor of Engineering (Honours)	300040	Mechanics of Materials	2018-11-07 00:00:00	Autumn Session	
10003099	3740	Bachelor of Engineering (Honours)	300035	Kinematics and Kinetics of Machines	2018-11-07 00:00:00	Autumn Session	
10003099	3740	Bachelor of Engineering (Honours)	200238	Mathematics for Engineers 2	2018-05-12 00:00:00	Spring Session	
10003099	3740	Bachelor of Engineering (Honours)	200238	Mathematics for Engineers 2	2018-02-22 00:00:00	Summer A Se	
10003099	3740	Bachelor of Engineering (Honours)	300965	Engineering Materials	2017-11-21 00:00:00	Spring Se	
10003099	3740	Bachelor of Engineering (Honours)	300964	Introduction to Engineering Practice	2017-06-28 00:00:00	Autum	
10003099	3740	Bachelor of Engineering (Honours)	300963	Engineering Physics	2017-06-28 00:00:00	Au	
10003099	3740	Bachelor of Engineering (Honours)	300743	Mathematics for Engineers Preliminary	2017-06-28 00:00:00		
10003099	3740	Bachelor of Engineering (Honours)	300463	Fundamentals of Mechanics	2017-11-21 00:0		
10003099	3740	Bachelor of Engineering (Honours)	300027	Engineering Computing	2017-06-2		
10003099	3740	Bachelor of Engineering (Honours)	300480	Dynamics of Mechanical Systems	201		
3666	8062	Doctor of Philosophy - Psychology	800163	HDR - Under Examination			
	8062	Doctor of Philosophy - Psychology	800163	HDR - Under Examination			
		Doctor of Philosophy - Psychology	800027	Higher Degree Research Thesis - Psych			
		Philosophy - Psychology	800027	Higher Degree Research Th			

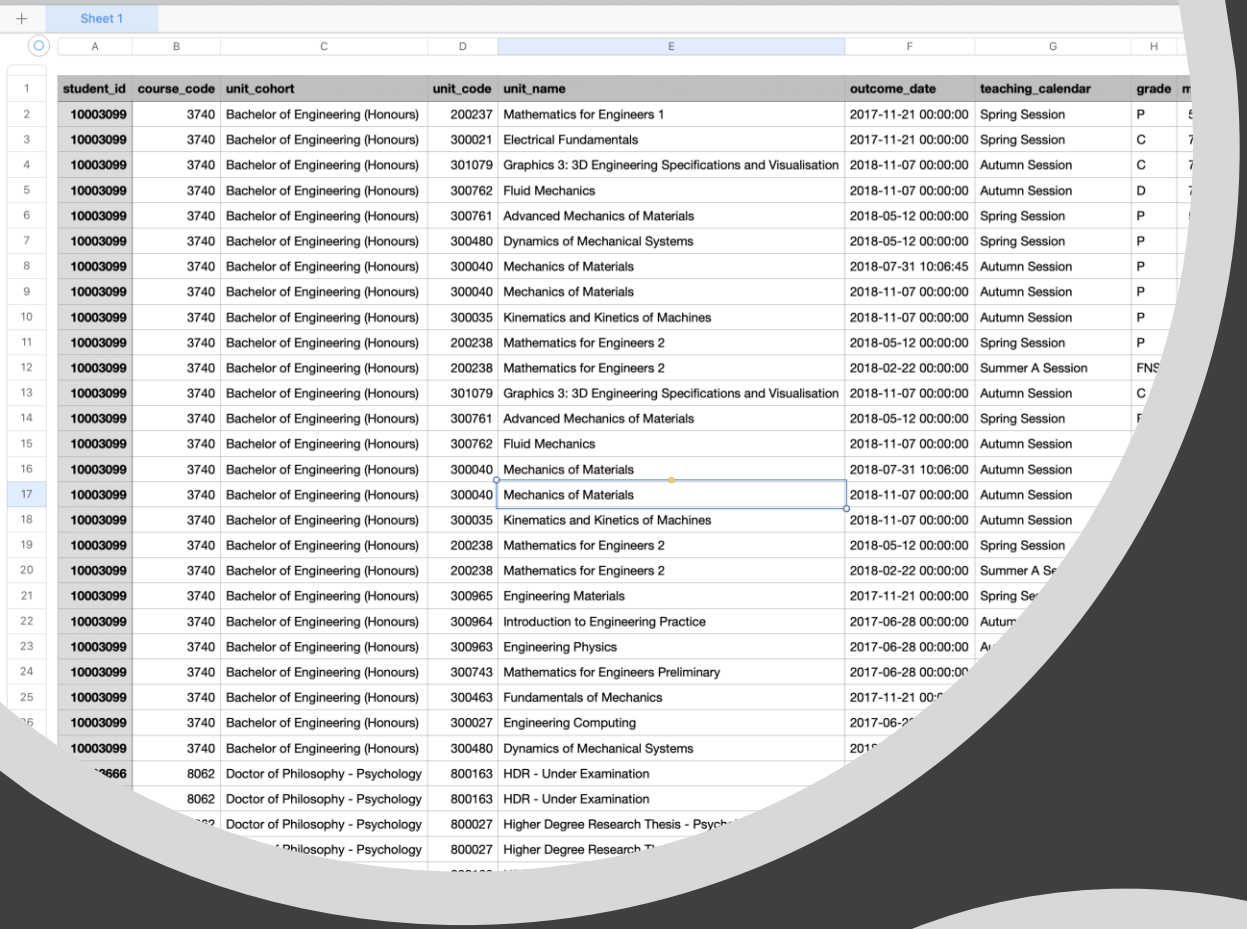


Data Collection & Challenges of Big Data

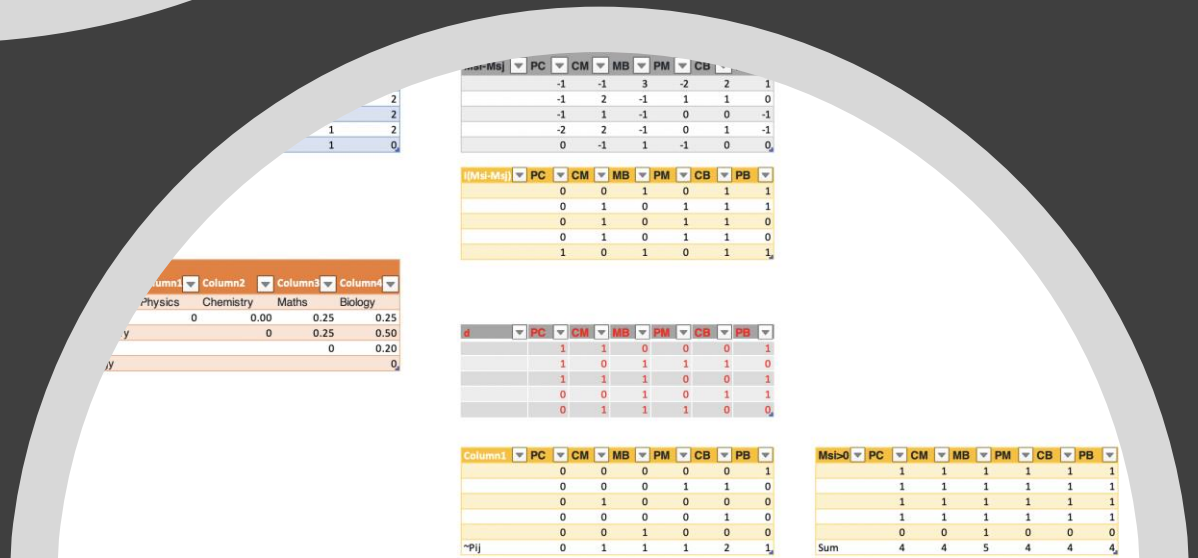
- Data extracted from Callista & Data Warehouse tables
- Need to handle 1.2 mill datapoints (1GB)
- Cannot be handled in Excel
- Data organization can’t be done manually.
- Needed to use CSV format & work in Python.

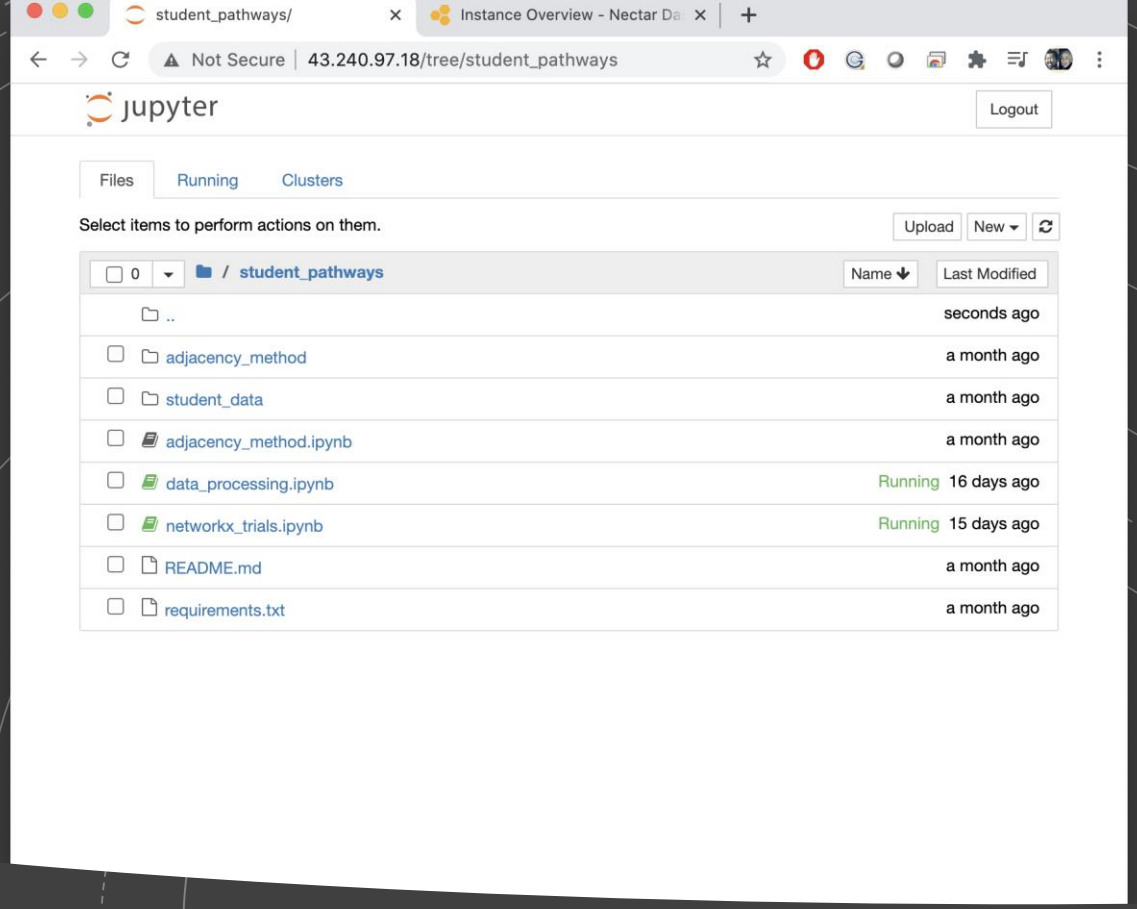
Data Collection & Challenges of Big Data

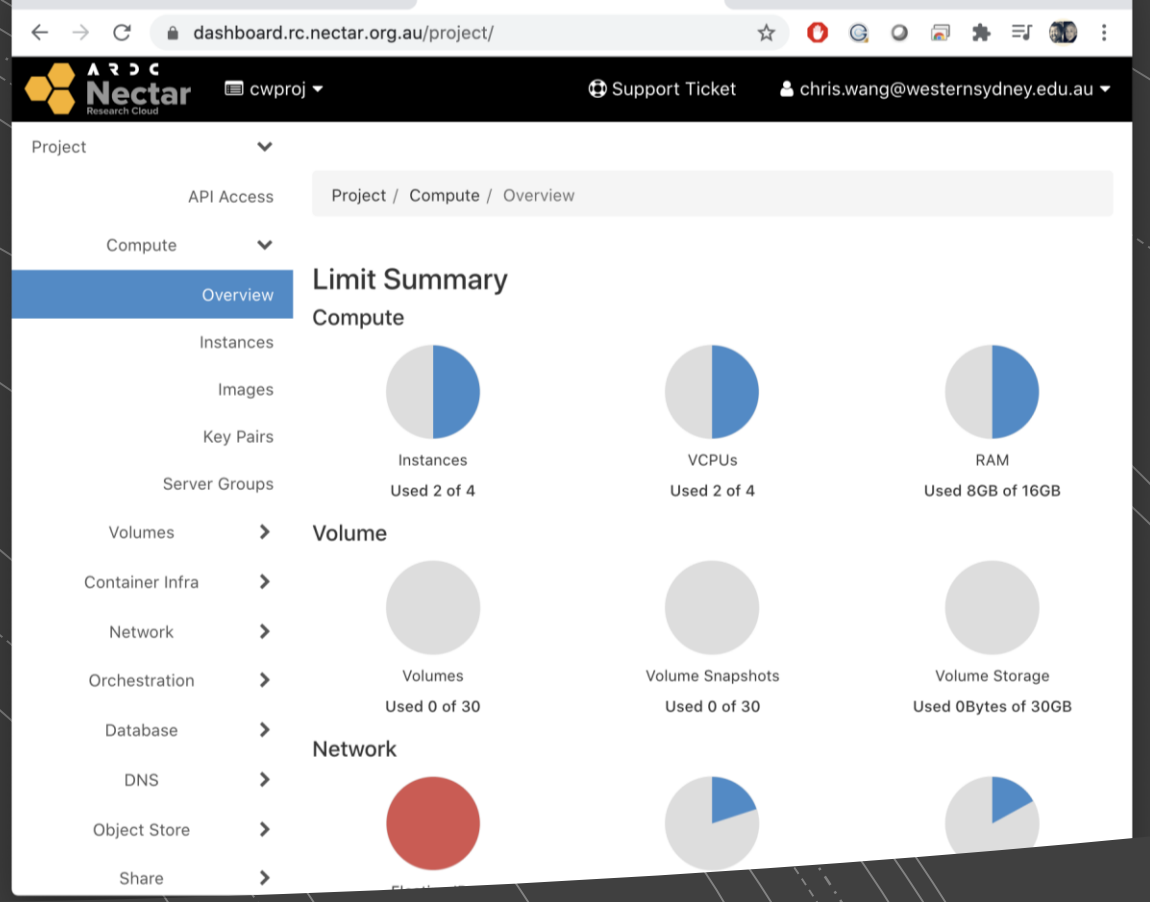
- Requires higher computing power.
- Required use of a high performance computer
- Computations initially took 90min of computation time
- Require smart programming to reduce this to 2-3min



student_id	course_code	unit_cohort	unit_code	unit_name	outcome_date	teaching_calendar	grade
10003099	3740	Bachelor of Engineering (Honours)	200237	Mathematics for Engineers 1	2017-11-21 00:00:00	Spring Session	P
10003099	3740	Bachelor of Engineering (Honours)	300021	Electrical Fundamentals	2017-11-21 00:00:00	Spring Session	C
10003099	3740	Bachelor of Engineering (Honours)	301079	Graphics 3: 3D Engineering Specifications and Visualisation	2018-11-07 00:00:00	Autumn Session	C
10003099	3740	Bachelor of Engineering (Honours)	300762	Fluid Mechanics	2018-11-07 00:00:00	Autumn Session	D
10003099	3740	Bachelor of Engineering (Honours)	300761	Advanced Mechanics of Materials	2018-05-12 00:00:00	Spring Session	P
10003099	3740	Bachelor of Engineering (Honours)	300480	Dynamics of Mechanical Systems	2018-05-12 00:00:00	Spring Session	P
10003099	3740	Bachelor of Engineering (Honours)	300040	Mechanics of Materials	2018-07-31 10:06:45	Autumn Session	P
10003099	3740	Bachelor of Engineering (Honours)	300040	Mechanics of Materials	2018-11-07 00:00:00	Autumn Session	P
10003099	3740	Bachelor of Engineering (Honours)	300035	Kinematics and Kinetics of Machines	2018-11-07 00:00:00	Autumn Session	P
10003099	3740	Bachelor of Engineering (Honours)	200238	Mathematics for Engineers 2	2018-05-12 00:00:00	Spring Session	P
10003099	3740	Bachelor of Engineering (Honours)	200238	Mathematics for Engineers 2	2018-02-22 00:00:00	Summer A Session	FNS
10003099	3740	Bachelor of Engineering (Honours)	301079	Graphics 3: 3D Engineering Specifications and Visualisation	2018-11-07 00:00:00	Autumn Session	C
10003099	3740	Bachelor of Engineering (Honours)	300761	Advanced Mechanics of Materials	2018-05-12 00:00:00	Spring Session	P
10003099	3740	Bachelor of Engineering (Honours)	300762	Fluid Mechanics	2018-11-07 00:00:00	Autumn Session	
10003099	3740	Bachelor of Engineering (Honours)	300040	Mechanics of Materials	2018-07-31 10:06:00	Autumn Session	
10003099	3740	Bachelor of Engineering (Honours)	300040	Mechanics of Materials	2018-11-07 00:00:00	Autumn Session	
10003099	3740	Bachelor of Engineering (Honours)	300035	Kinematics and Kinetics of Machines	2018-11-07 00:00:00	Autumn Session	
10003099	3740	Bachelor of Engineering (Honours)	200238	Mathematics for Engineers 2	2018-05-12 00:00:00	Spring Session	
10003099	3740	Bachelor of Engineering (Honours)	200238	Mathematics for Engineers 2	2018-02-22 00:00:00	Summer A Se	
10003099	3740	Bachelor of Engineering (Honours)	300965	Engineering Materials	2017-11-21 00:00:00	Spring Se	
10003099	3740	Bachelor of Engineering (Honours)	300964	Introduction to Engineering Practice	2017-06-28 00:00:00	Autum	
10003099	3740	Bachelor of Engineering (Honours)	300963	Engineering Physics	2017-06-28 00:00:00	A	
10003099	3740	Bachelor of Engineering (Honours)	300743	Mathematics for Engineers Preliminary	2017-06-28 00:00:00		
10003099	3740	Bachelor of Engineering (Honours)	300463	Fundamentals of Mechanics	2017-11-21 00:0		
10003099	3740	Bachelor of Engineering (Honours)	300027	Engineering Computing	2017-06-2		
10003099	3740	Bachelor of Engineering (Honours)	300480	Dynamics of Mechanical Systems	201		
3666	8062	Doctor of Philosophy - Psychology	800163	HDR - Under Examination			
	8062	Doctor of Philosophy - Psychology	800163	HDR - Under Examination			
		Doctor of Philosophy - Psychology	800027	Higher Degree Research Thesis - Psych			
		Philosophy - Psychology	800027	Higher Degree Research Th			







Data Security:

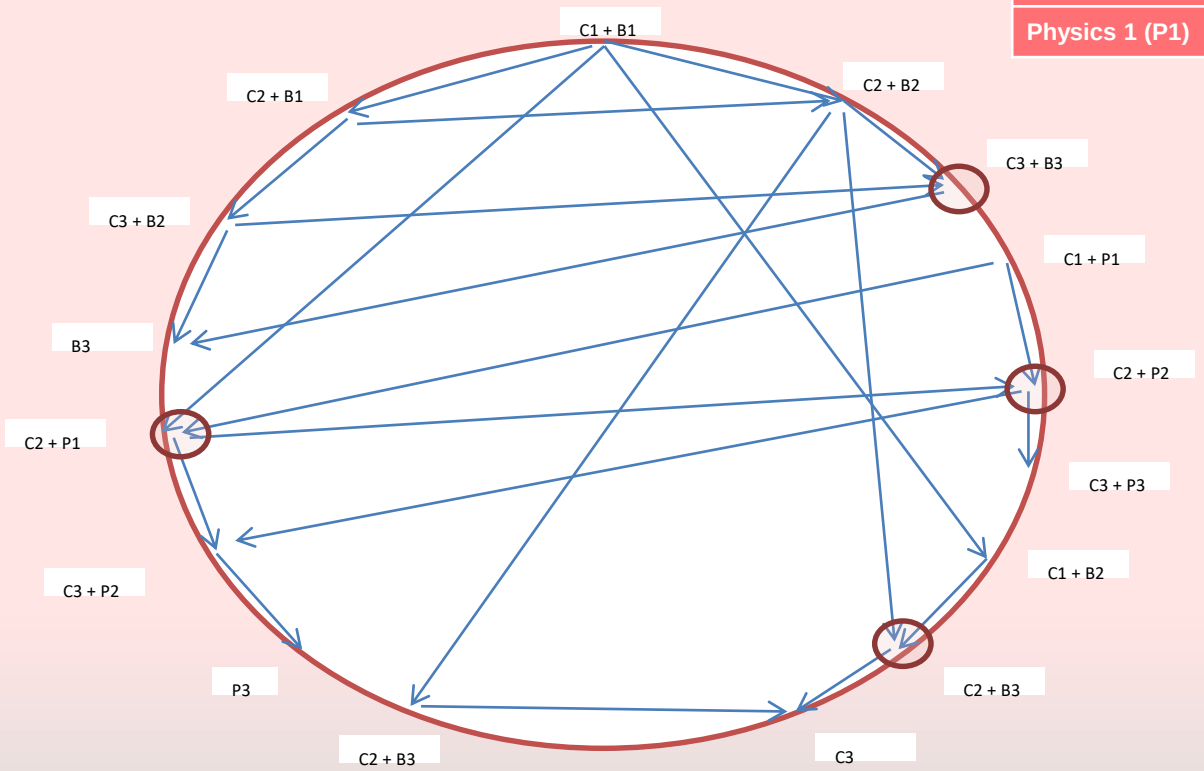
- Student was encrypted so that it is de-identified even to us.
- Stored inside secure space in University domain.

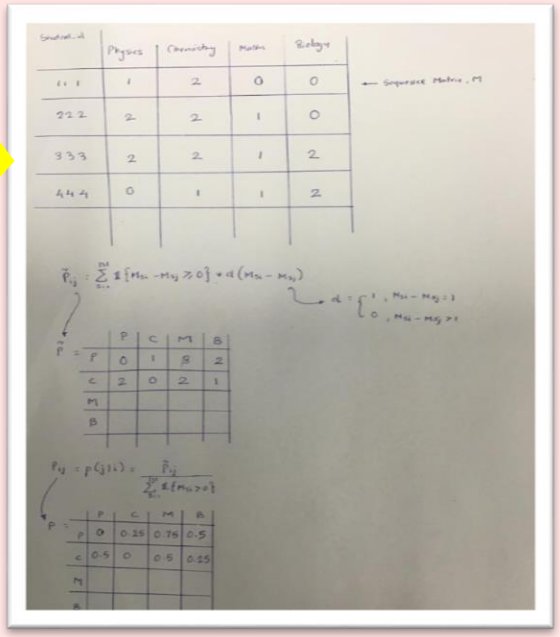
Concept & Pilot Run

WESTERN SYDNEY UNIVERSITY

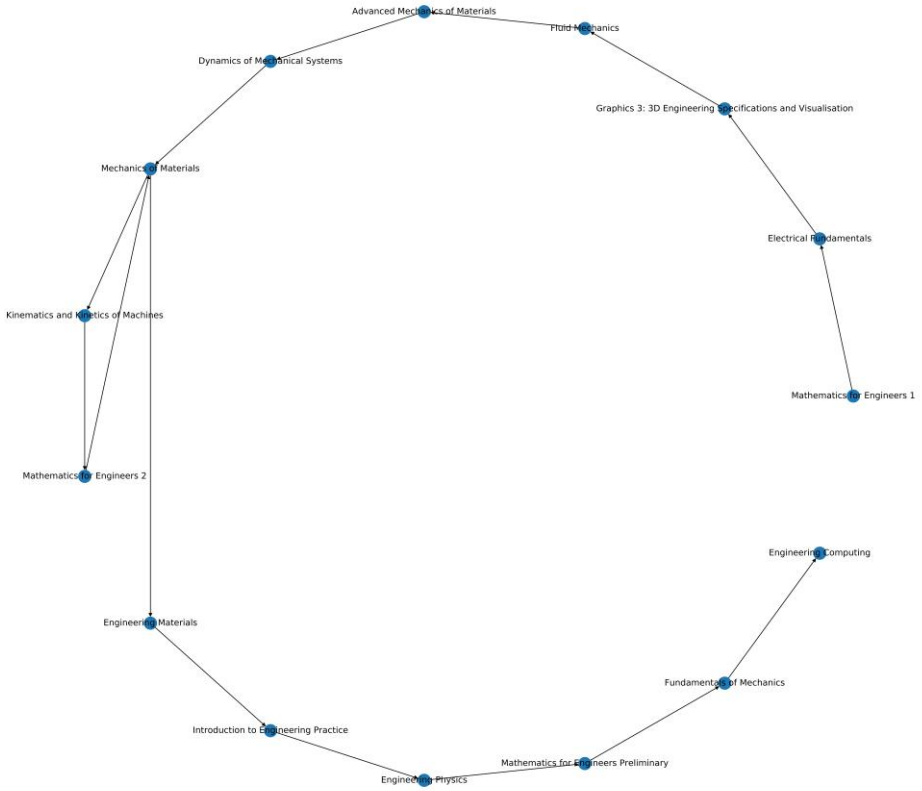
Student Unit choices & Pilot analysis :

1st Year	2nd Year	3rd Year
Chemistry 1 (C1)	Chemistry 2 (C2)	Chemistry 3 (C3)
Biology 1 (B1)	Biology 2 (B2)	Biology 3 (B3)
Physics 1 (P1)	Physics 2 (P2)	Physics 3 (P3)

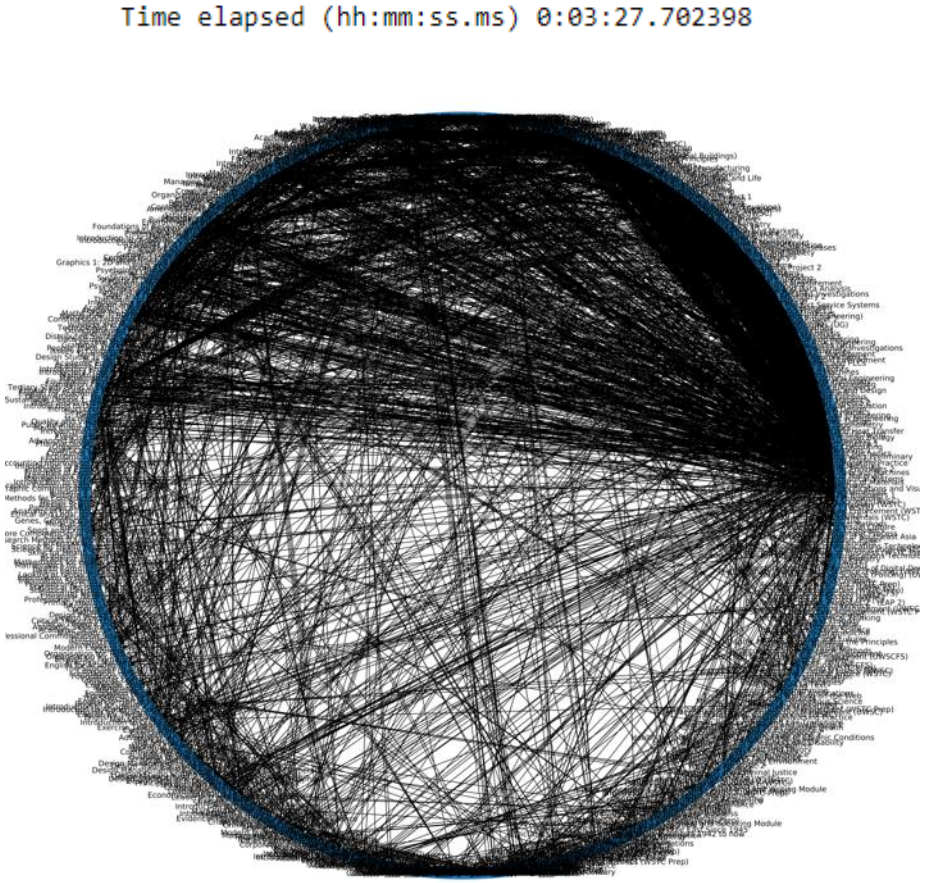




Data Analysis and Pilot Finding



1 Student from Engineering

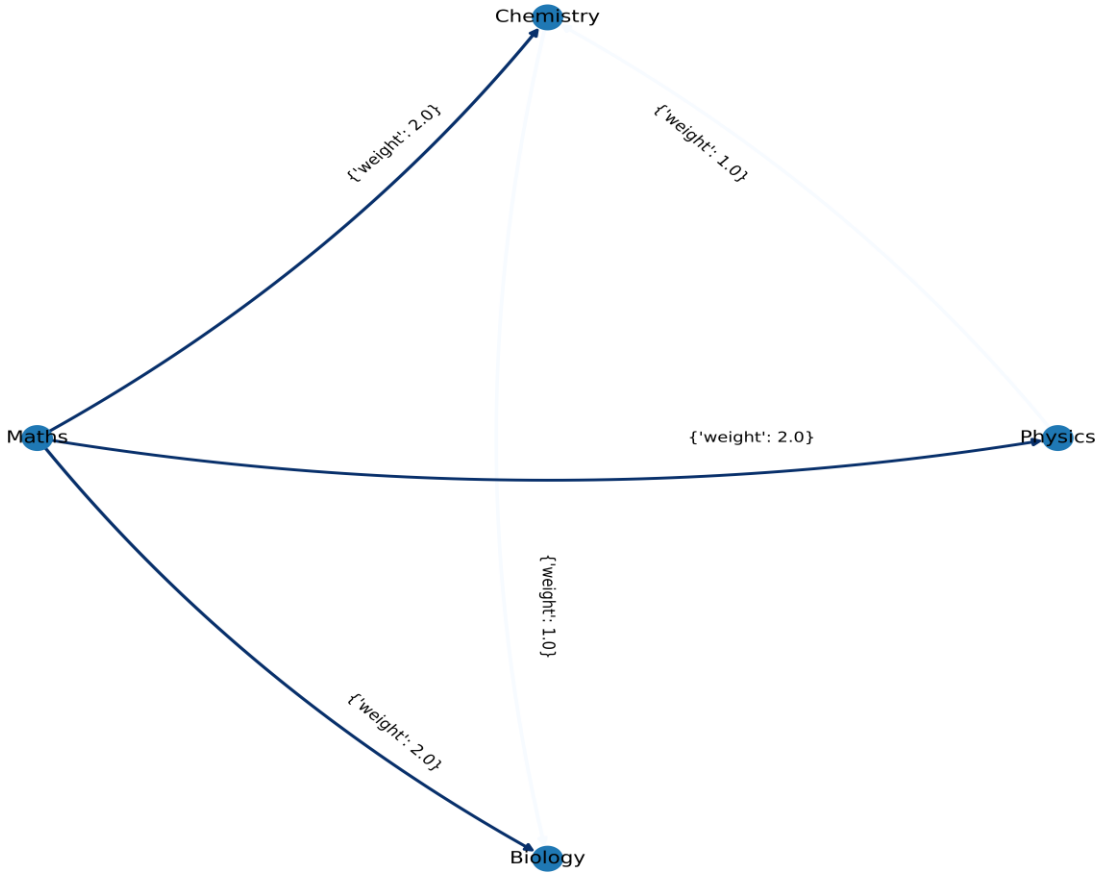


Engineering dataset

Data Analysis/Pilot findings

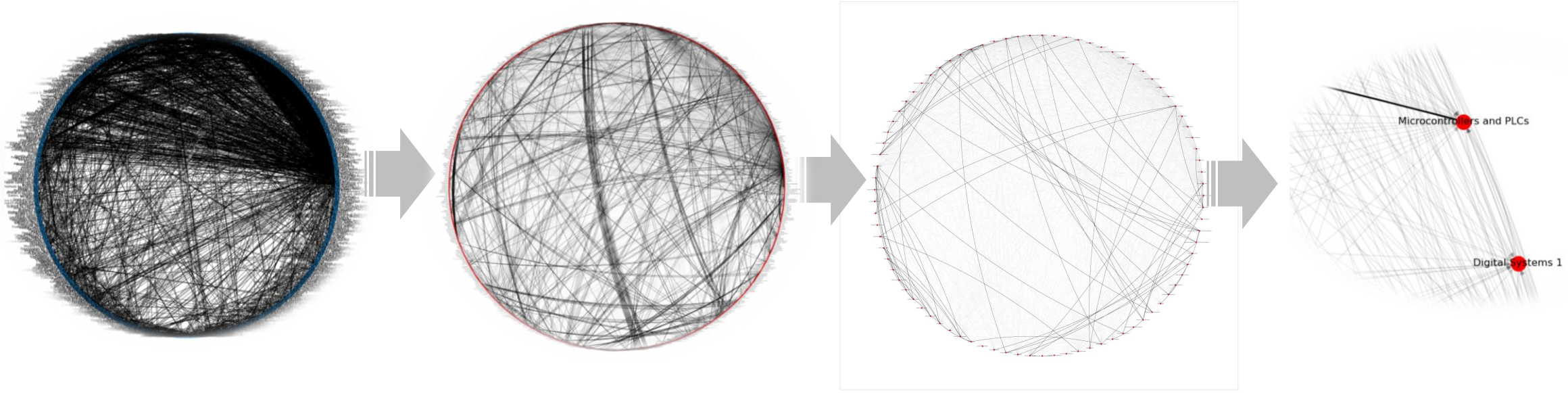
WESTERN SYDNEY UNIVERSITY

- ✓ Evaluated number of records which failed
- ✓ Hence developed mathematical formulae to process the big data
- ✓ Define the students pathways
- ✓ Data consolidation for big data for > 4 yrs
- ✓ Pilot run with test dataset
- ✓ Kicked off with a small test data analysis

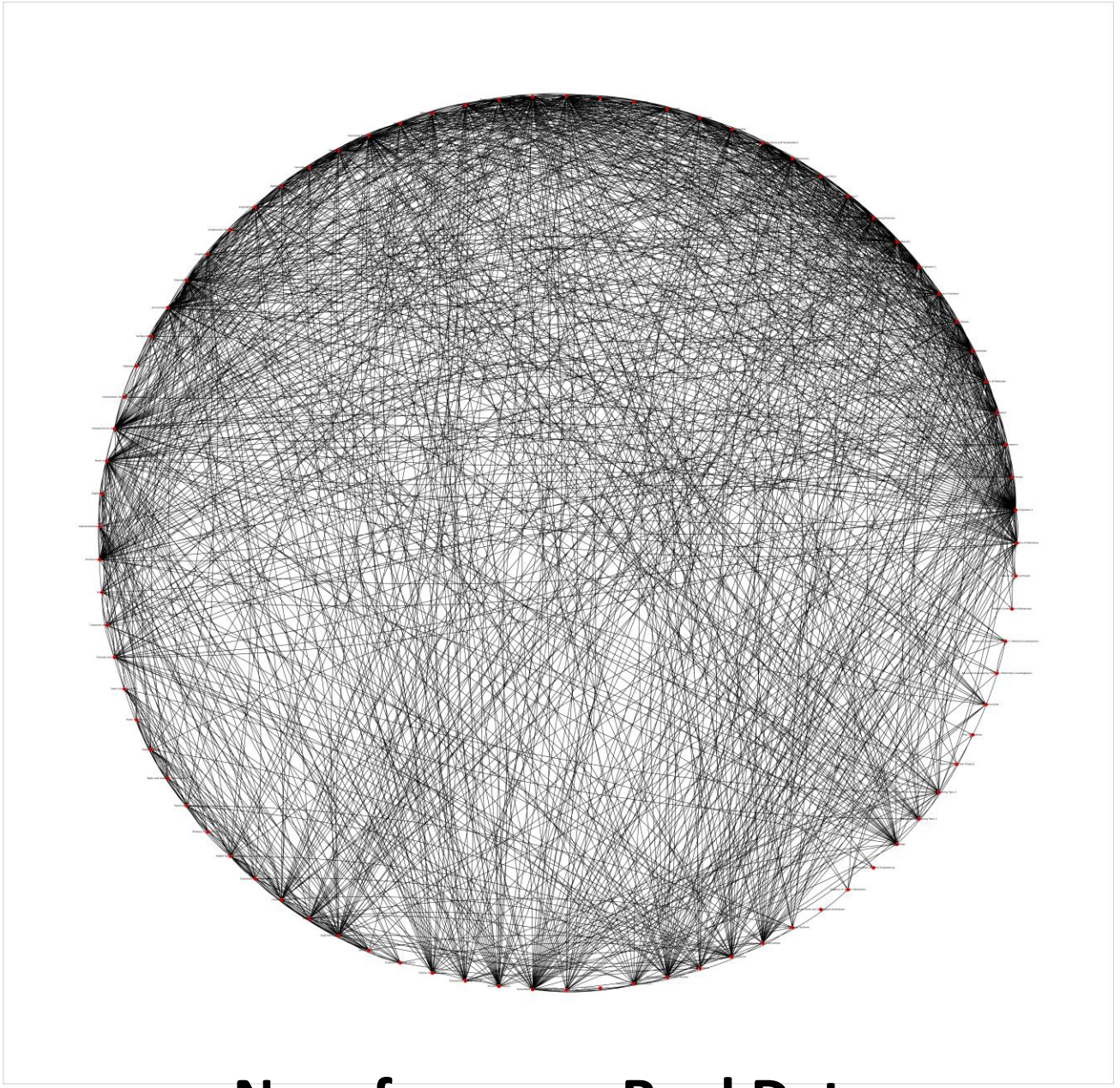


WESTERN
OUR NEW NORMAL

From complex diagrams to better interpretation through algorithms & Python



Filtered the data to only incorporate cohort specific units
A threshold applied to highlight the links



Now for some Real Data

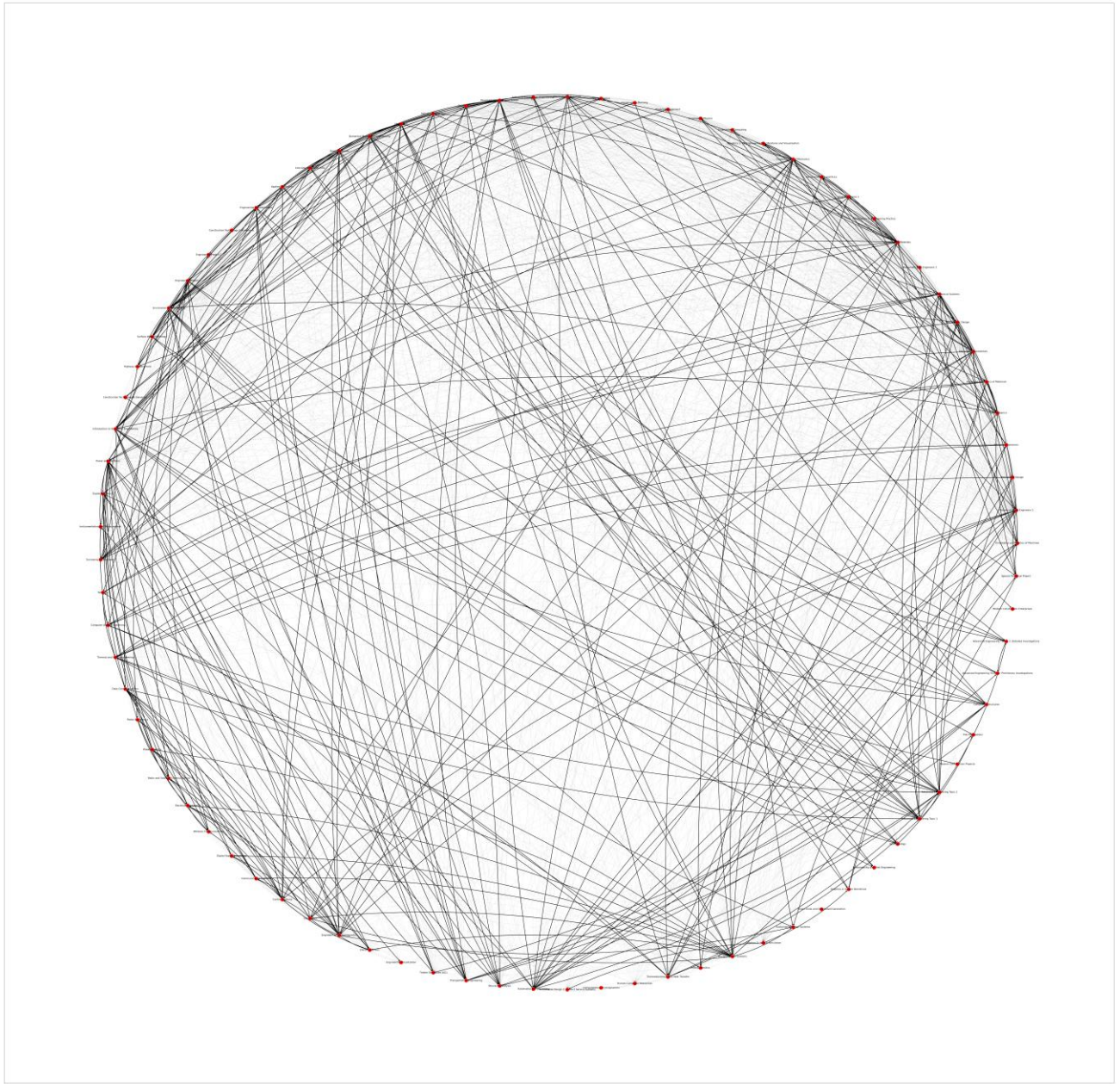
Engineering
Undergraduate Course

2014-2019

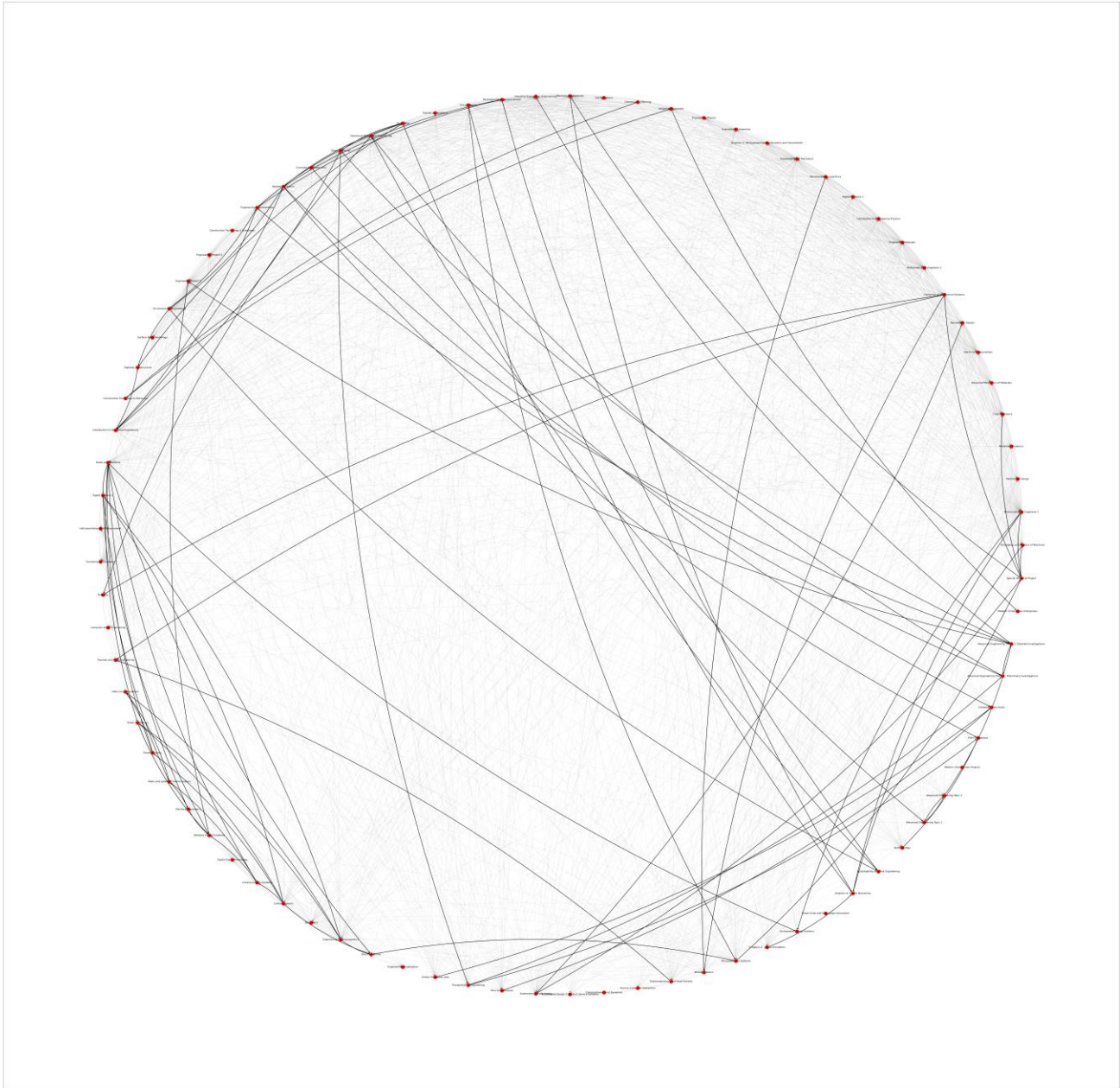
Students = 980

Data Points = 11,379

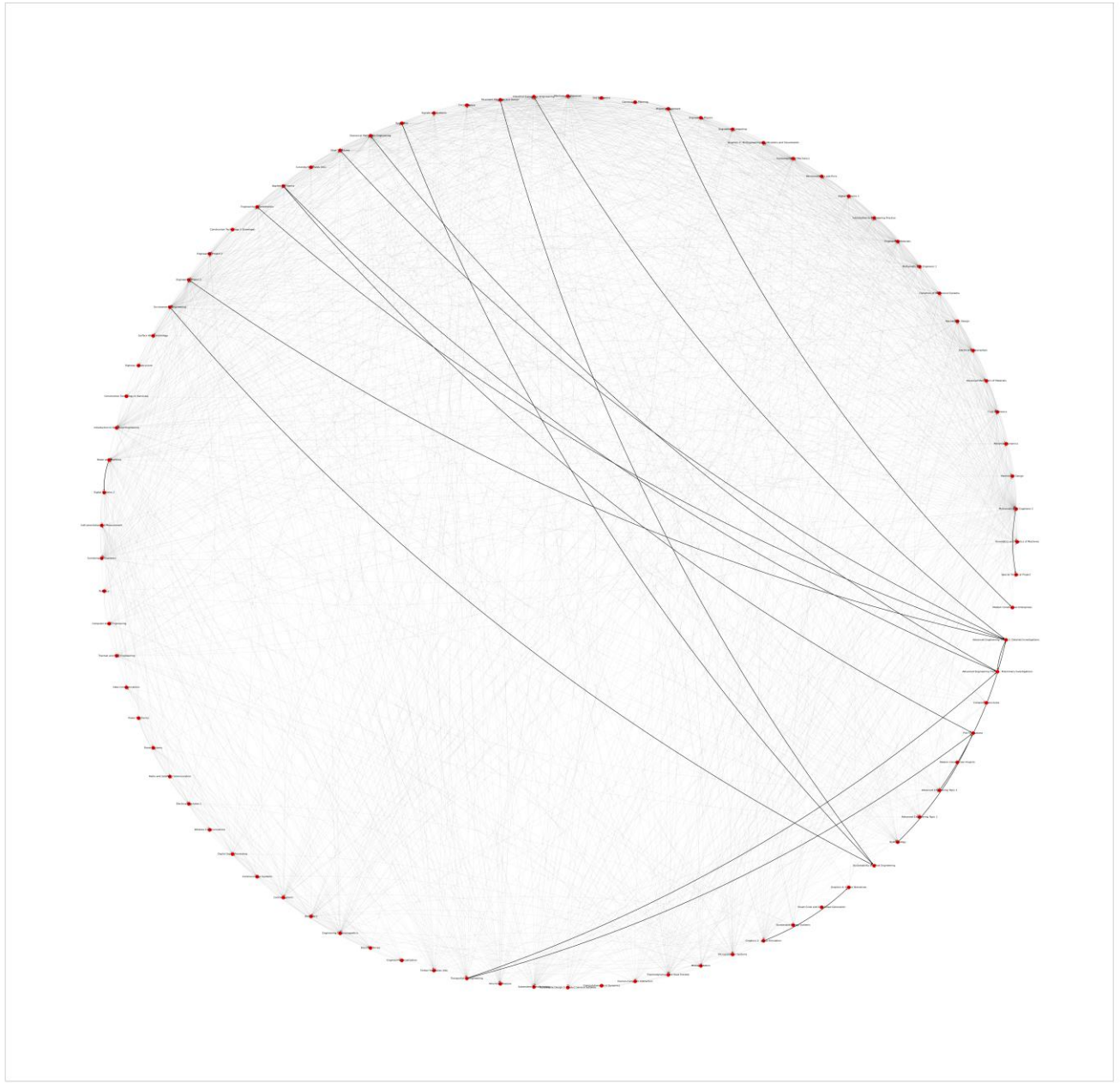
Threshold >= 25%



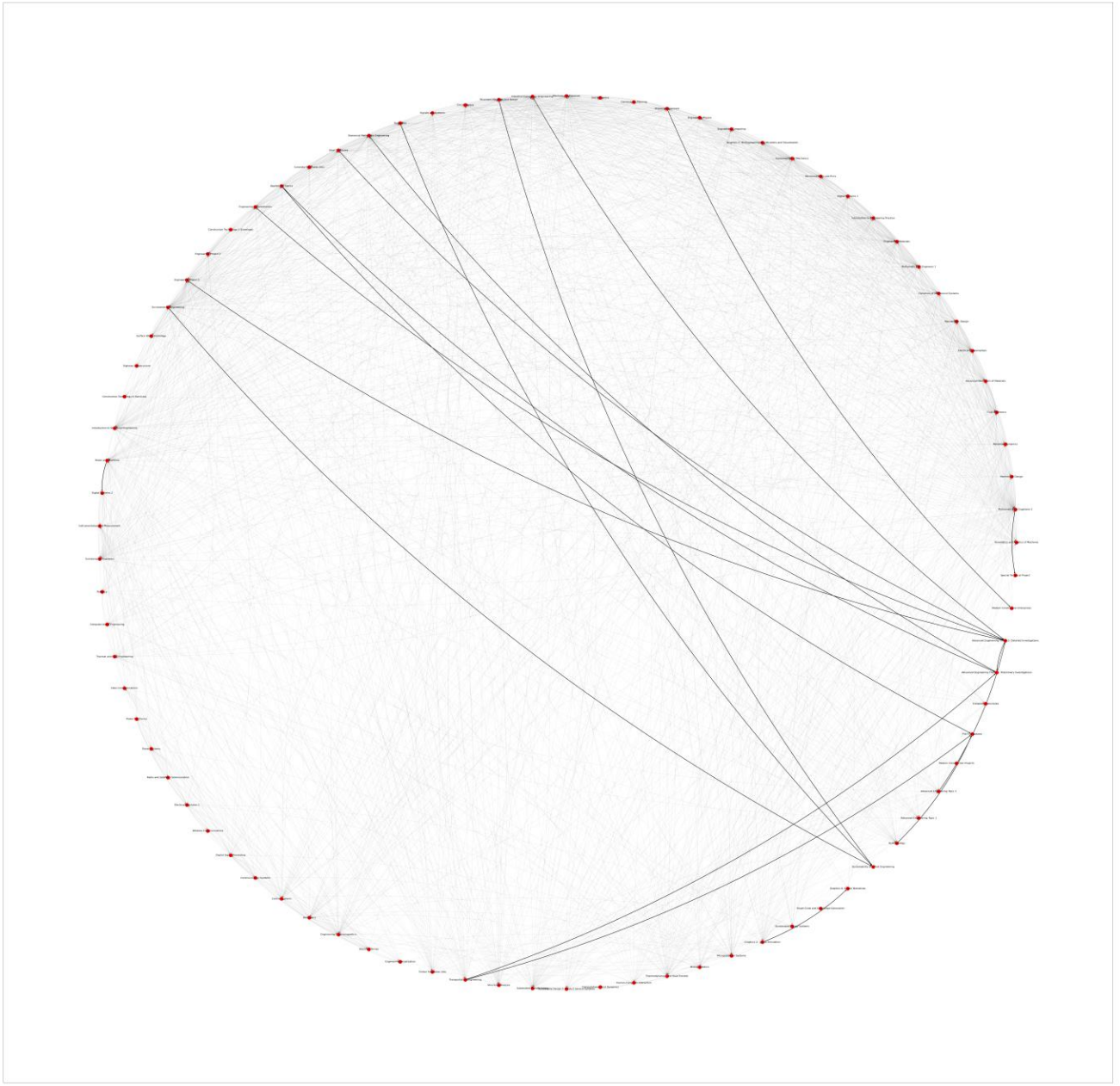
Threshold >= 50%



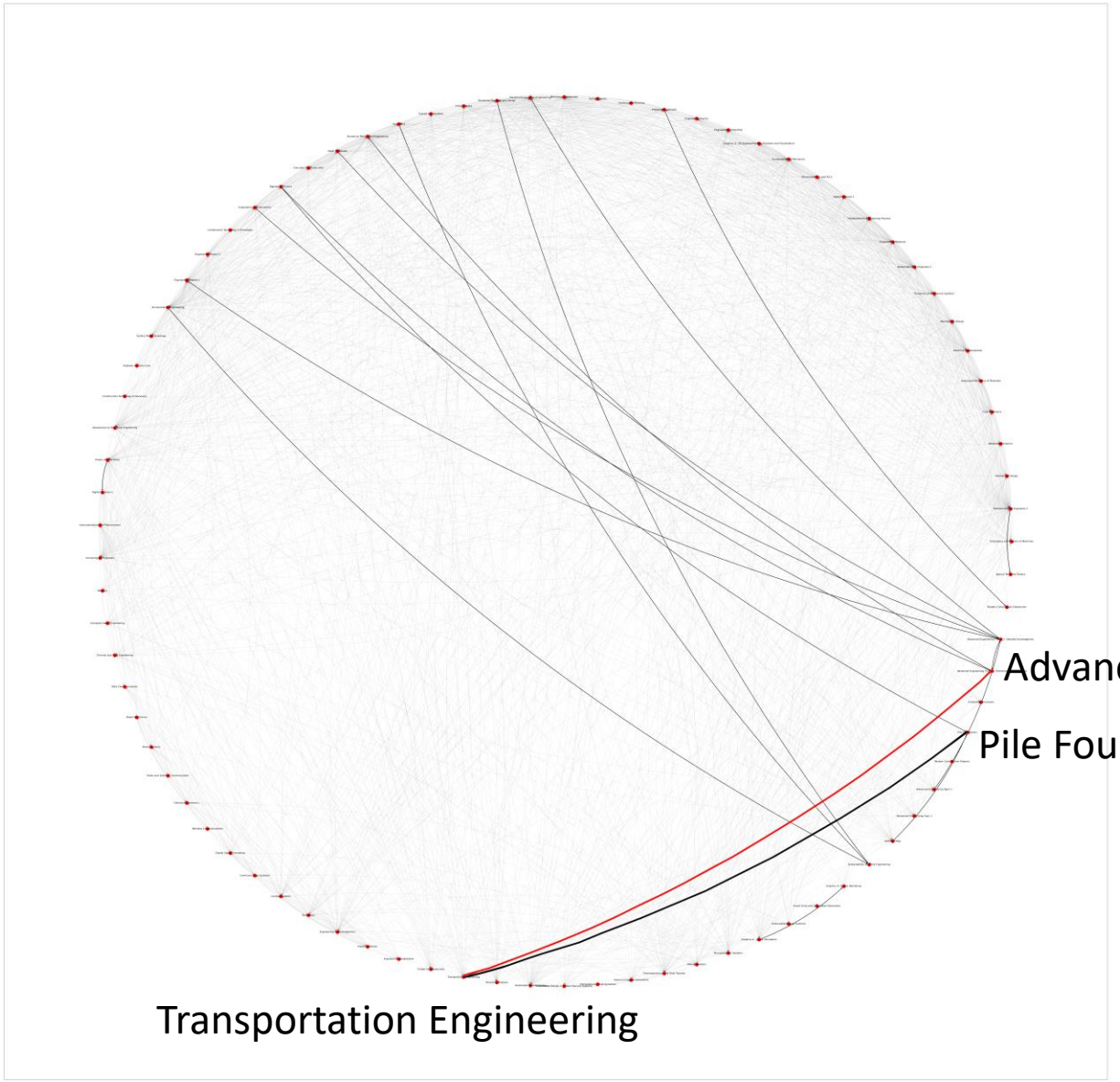
Threshold >= 75%



Threshold >= 90%



Pathways (highlighted)
Threshold >= 90%



Milestones Reached

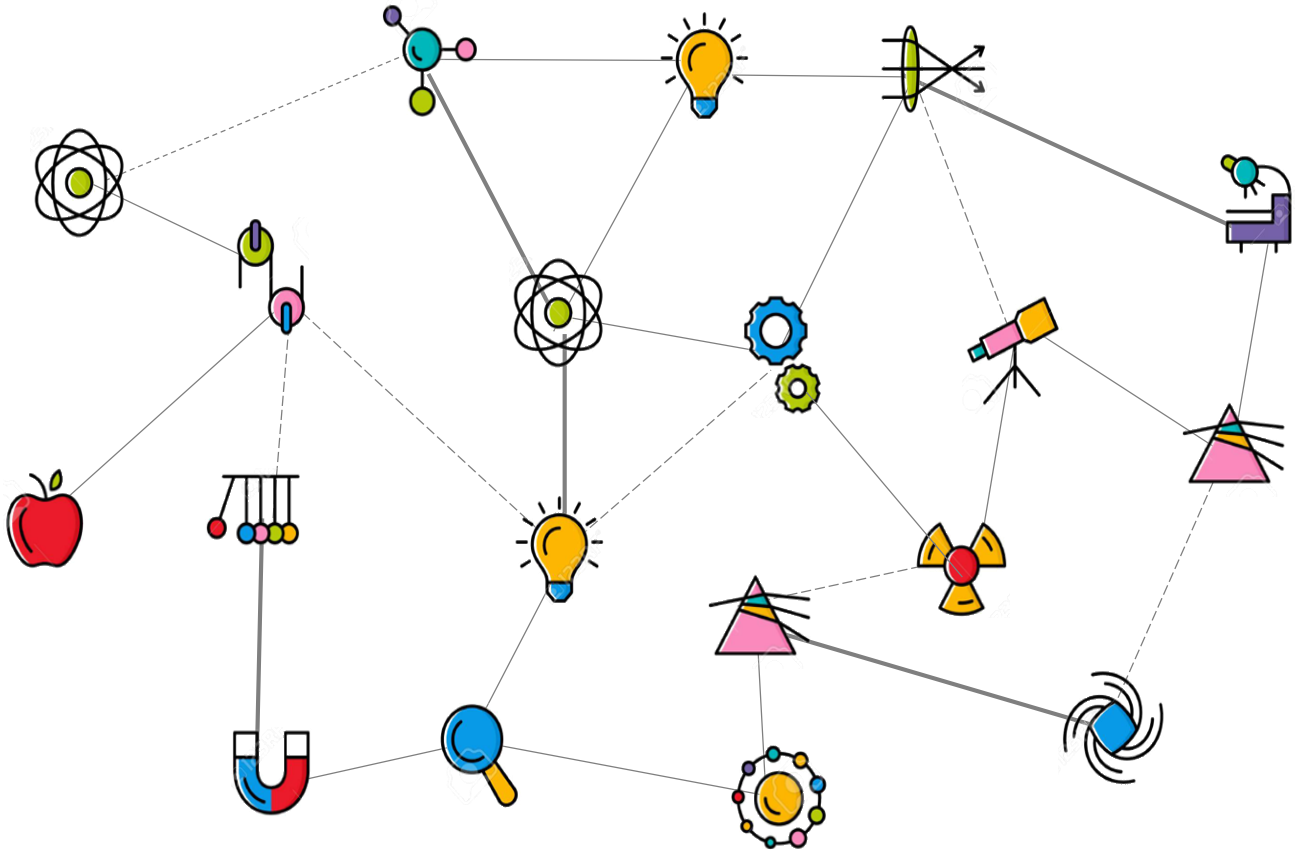
- Successfully managed a project remotely during COVID.
- We have overcome the challenges how to structure & manage large data sets
- We have developed our own programming tool kit for student unit enrolment analysis
- We now have an understanding of how complex student unit enrolment pathways can be.
- We are well on our way to developing a useable tool for staff to predict student unit enrolment loads ahead of semesters.

Future Work

Graph Neural Network Approaches

Continue to develop the programming tool kit

Create a usable tool for support staff to predict student unit enrolment loads.



Project Team
Chris Wang – Senior Technical Officer - TSS (MARCS)
Vivek Dafre - Data Analyst -TSS

Data Support

Tony Lazzara (Executive Director, Business Intelligence and Performance),
Sharath Purighalla (Senior Manager Analytics & Data Strategy)
Chitra Suriyarachchi(Manager, Enterprise Data)

Nectar – for high performance computing resources

WESTERN

OUR NEW NORMAL

PROFESSIONAL STAFF CONFERENCE

Tuesday 1 September 2020, via Zoom

WESTERN SYDNEY
UNIVERSITY