



INFORMATION SESSION

Wednesday, April 5, 2023

UC San Diego
JACOBS SCHOOL OF ENGINEERING
Executive Education

The background of the slide features a photograph of a modern, multi-story building with a glass facade and balconies. The image is overlaid with a semi-transparent blue filter and two prominent diagonal stripes in a darker shade of blue, creating a dynamic geometric pattern.

WELCOME & INTRODUCTIONS

Director, Engineering Executive Education: Gary Henderson

AGENDA

- 6:00 Introductions
- 6:05 Master of Advanced Studies Overview
- 6:15 Wireless Embedded Systems (WES)
- 6:30 Architecture-based Enterprise Systems Engineering (AESE)
- 6:45 Data Science and Engineering (DSE)
- 7:00 Next Steps
- 7:05 Q&A

MAS STAFF



Yvonne Wu

Assistant Director &
Program Manager,
DSE and WES



Stacey Williams

Program Manager,
AESE



Gary Henderson

Director, Engineering
Executive Education



Kristin Liljestrom

MAS Ops and
Administration



Samantha Wong

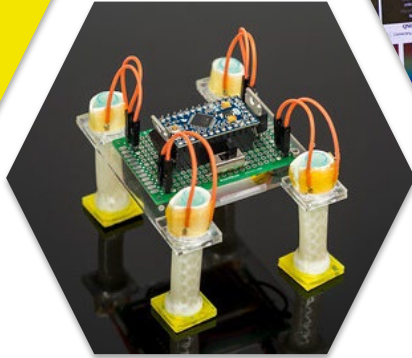
MAS Administrative
Coordinator

UC SAN DIEGO JACOBS SCHOOL OF ENGINEERING

- Jacobs School of Engineering (largest in CA among public universities)
- Ranked 10th top engineering school in the nation
- Distinguished faculty (>275 research-active faculty)
- Commitment to serving needs of industry for latest in research and education
- More rankings information can be found here: <https://jacobsschool.ucsd.edu/about/rankings>

Partnerships & Collaboration

Computer Science
and Engineering



Electrical and
Computer Engineering



Mechanical and
Aerospace Engineering

San Diego
Supercomputer Center



Rady School of
Management



Qualcomm Institute

Images: David Baillot and Erik Jepsen
UC San Diego

4Med Imaging Solution	Callaway Golf	Forcepoint	KEDZIG	NuVasive	Sycuan Casino
Abbott Laboratories	Caltrans	Ford Motor Company	Kelpac Medical	Obzervant	SynteractHCR
Abbott Vascular Devices	Caradigm	Forward Slope	Kiran Analytics	Oncore Manufacturing	Tandem Diabetes
Accenture	Carefusion	Future Education	Komaru Technologies	OneRoof Energy	TASC
Active Mind Technology	Carollo Engineers	Galaxy	Kontron America	Optum360/United Health Group	Teco Diagnostics
Advanced Brain Monitoring	Catheter Connections	Gas and Power Technologies	kWh Analytics – Solar Risk Management	Panasonic	Teradata
AeroAstroTech	CeloNova BioSciences	Genentech	Lead Crunch	Parastack	Texas Instruments
ai-one	Circadence	General Atomics	Leica Systems	Pegasystems	Thermo Fisher Scientific
Ajinomoto Althea	Clarity Design	Gimbal	Leidos	Peregrine Semiconductor	Ticom Geomatics
Alion Science and Technology	Classic Wire Cut	GlySens	Life Technologies	Pfizer	TrellisWare
Alphatec Spine	CodeMetro	Goal Structured Solutions	LifeNet Health	PluralProQinase GmbH	Triage Consulting Group
American Bureau of Shipping	Cognex Corporation	Google	LinkedIn	Qualcomm	Turn Key
Angeles Crest Engineering	CoStar Group	GoPro	Loan Depot	Raytheon	Ubiquomm
Apex Biotechnology	Covidien	greenfence	Lockheed Martin	Resonetics	UCSD Health
Applied Medical	Coway USA	Growth 2.0	Los Angeles Dodgers	SAIC	UCSD Info Technology Services
AT Dynamics	Crafter Brothers	Harper Construction	Lucent-Alcatel	Samsung	UCSD Medical Center
Athena Mobile	Cubic Global Defense	Hewlett Packard	Makena Technologies	San Diego State University	UCSD Research Administration
Automatic Data Processing	Cubic Mission Systems	Hologic	Medimexico	Scripps Health	UCSD SIO
BAE Systems	Cubic Transportation Systems	Hospira	MedImpact	Scripps Institute, UC San Diego	UCSD SDSC
Bank of America	Cymer	Hyundai Mobis	Medtronic Ablation Frontiers	SeaSpine	United States Navy
Bank of America Home Loans	D&K Engineering	IBM	Medtronic Minimed	Sentek Global	United Technologies Aerospace
Barona Resort & Casino	Deccan International	IKA	Metron Scientific Solutions	Servicios Quirugicos S.A.	Universal Hospital Services
Beckman Coulter	Dexcom	Illumina	Microsoft	Shutterfly	Uptake
Biopico Systems	EMN Defense Services	InfoSys	MITRE	Skillnet Solutions	Veyo
Biorxn	Encore Capital Group	Innovive	NAVAIR	SkySurgery	ViaSat
Boeing	Endologix	Inova Diagnostics	NAVWAR NIWC Pacific	Slacker Radio	Volcano
Booz Allen Hamilton	EnGenious Technologies	Integrand	Network Appliances (NetApp)	Social Nightlife	Vulcan Wireless
Branchpoint Technologies	Entropic Communications	INTEGRIS Group	Neustar	Solar Turbines	Walt Disney Company
Broadcom	Epic Systems	Intel	Nokia	Sony	Webroot
CA Technologies	ESRI	Intuit	Northrop Grumman AS	Stanford University	West Arbor Group
Cakesoft Technology	Fallbrook Engineering	JMJ Financial	Northrop Grumman MS	Stonehenge Financial Partners	Workday
California Correctional Health	FICO	John Wayne Cancer Institute	Novartis	Survice Engineering	Y8L Consulting
Care Services	FloQast	KAB Laboratories			Zodiam Pool Systems

MASTER OF ADVANCED STUDIES (MAS)

- Master's degree, conferred by the UC San Diego
- Professional degree programs designed for engineering and technical professionals
- Unique interdisciplinary degree program focused on emerging technology areas and new fields traditional curricula do not address
- MAS degree programs
 - AESE - Architecture-Based Enterprise Systems Engineering (since 2010)
 - WES - Wireless Embedded Systems (since 2011)
 - DSE - Data Science and Engineering (since 2014)
 - More in development!

PROGRAM DESIGN

- Graduate degrees that meet the needs of engineering and technical professionals
- Designed to address skills that are most needed to solve today's most pressing challenges
- Delivers integrated interdisciplinary knowledge
- Optimized for working professionals
- Cohort Design
- Small Class sizes
- Interactive and Application focused

GENERAL ADMISSIONS GUIDELINES

Program	Work Experience	2023 Application Deadlines	General Guidelines For All Programs
AESE	5 years	February 8th	Bachelor's degree in engineering, science, mathematics, physics, etc. No GRE 3.0 minimum GPA* No TOEFL if working in US for more than 1 year* \$135 (\$155 international) application fee**
WES	2 years	April 5th	
DSE	2 years	June 7th	

**Some exceptions. **Veterans may request fee waiver.*

PROGRAM SCHEDULE

	Schedule	Fall	Winter	Spring	Summer	Fall	Winter	Spring
AESE	1 Year (full-time) 42 units total	13 units ----- 3 classes + project	13 units ----- 3 classes + project	13 units ----- 3 classes + project	3 units ----- capstone			
WES	2 Years (part-time) 36 units total	4 units ----- 1 class	4 units ----- 1 class	4 units ----- 1 class	4 units ----- 1 class	8 units ----- 2 classes	8 units ----- 2 classes	4 units ----- capstone
DSE	2 Years (part-time) 38 units total	6 units ----- 1 class 1 seminar	8 units ----- 2 classes	8 units ----- 2 classes	no summer classes	8 units ----- 2 classes	6 units ----- 2 classes	2 units ----- capstone

FALL 2023 COHORTS PROGRAM COST

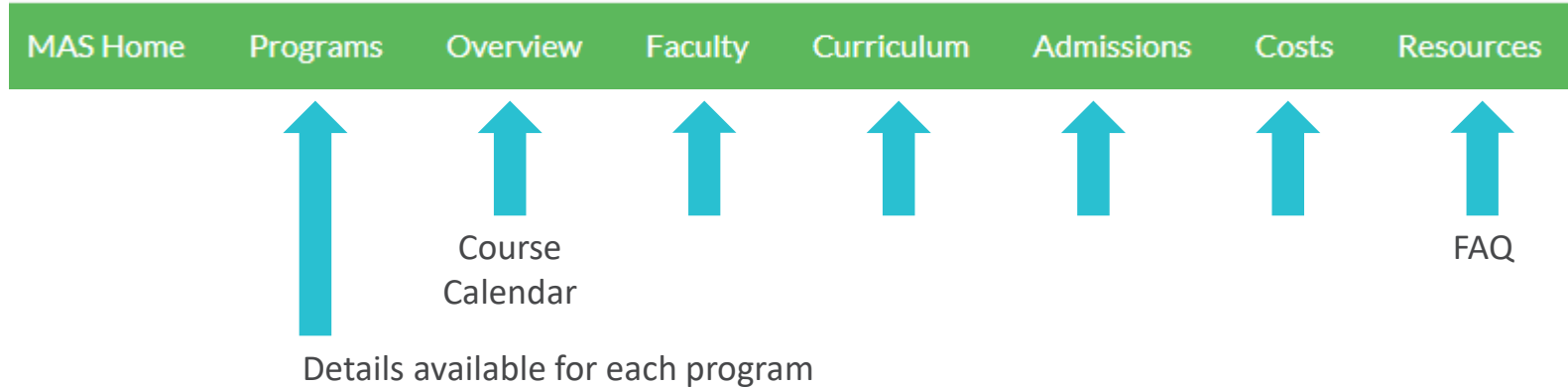
Program	Units	Per Unit Tuition*	Tuition Includes
AESE	42 (1 yr)	\$825/unit	Course Materials Software and Hardware Parking and Meals
WES	36 (2 yr)	\$1,045/unit	
DSE	38 (2 yr)	\$990/unit	

* *Proposed per unit cost for student starting Fall 2023. Pending UCOP approval.*

** *Does not include UC Graduate Student Fees: <https://students.ucsd.edu/finances/fees/registration/2022-23/self-supporting.html>*

SPECIFIC PROGRAM INFORMATION

Data Science & Engineering



<https://jacobsschool.ucsd.edu/mas>

In the interest of time, questions will be answered in the Program Specific Q/A after the presentation.

The background features a photograph of a modern, multi-story building with large glass windows and balconies. The image is overlaid with a semi-transparent blue filter. Two prominent diagonal lines in a slightly darker shade of blue cross the entire frame from corner to corner, creating a dynamic geometric pattern.

WIRELESS EMBEDDED SYSTEMS

Faculty Directors: Dr. Ryan Kastner and Dr. fred harris

Learn the fundamentals of wireless communications and embedded system design and build advanced wireless embedded systems using modern design tools.

OVERVIEW

Faculty Directors

Dr. Ryan Kastner – Professor of Computer Science and Engineering

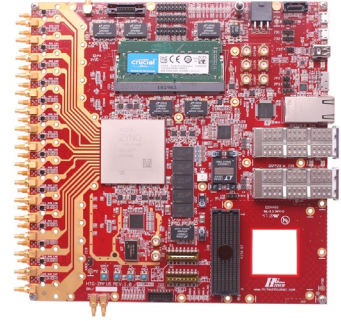
Dr. fred harris – Professor of Electrical and Computer Engineering

Intended Audience

Engineering professionals with a background in computer science and/or electrical engineering

Courses

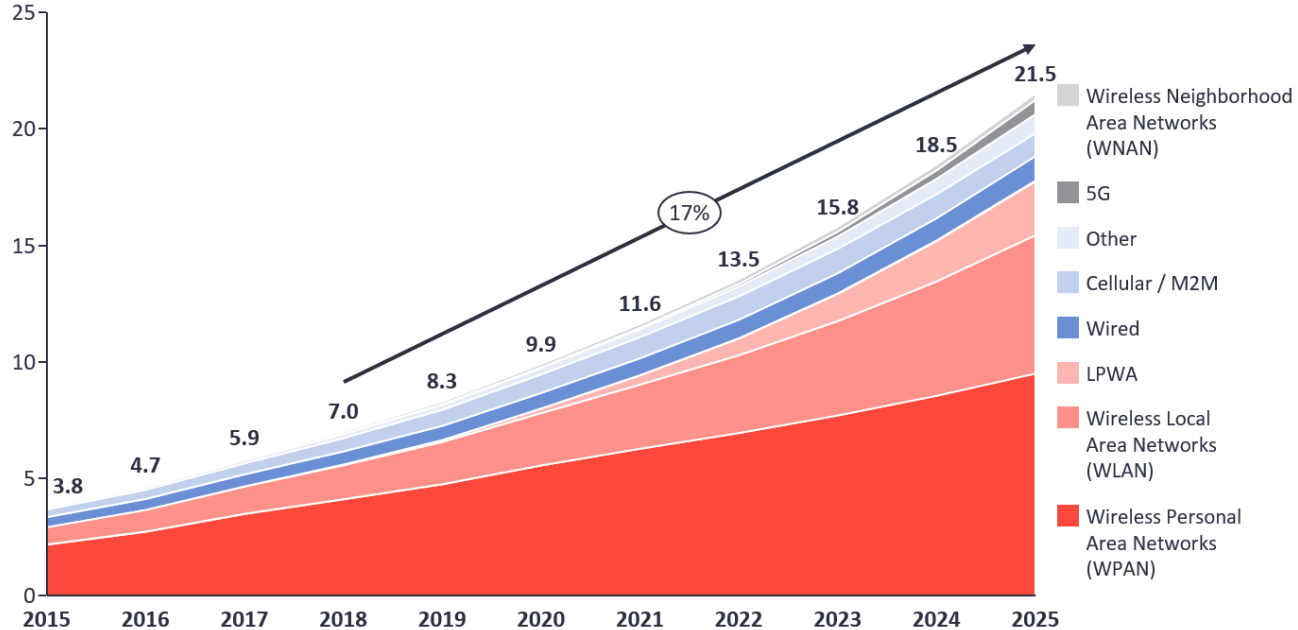
2-year program (Sep 2023 – June 2025) with classes on alternating Saturdays or Fri/Sat
7 quarters, including summer 2024



Computer Science and
Engineering
+
Electrical and
Computer Engineering

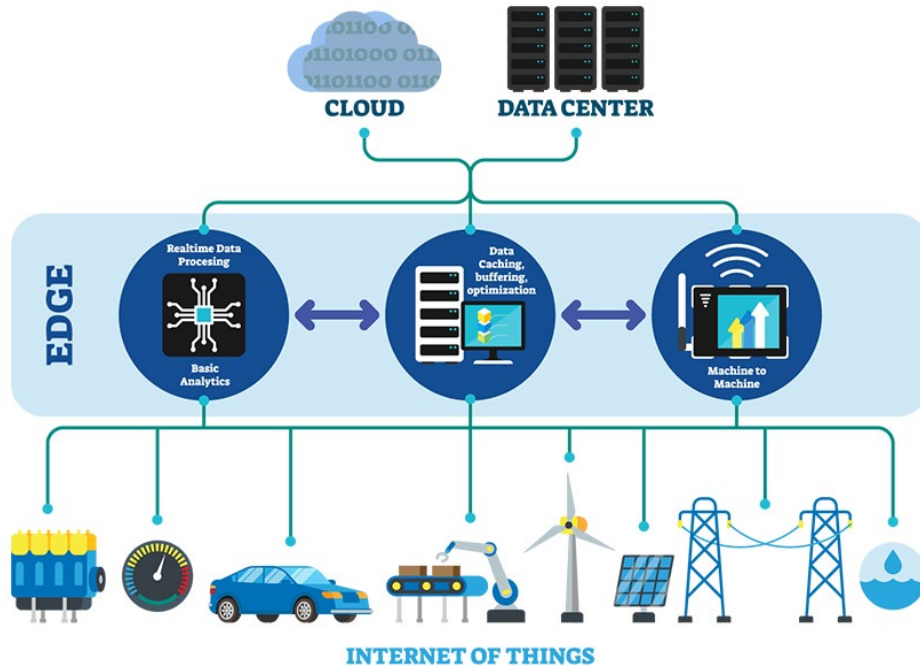
Global Number of Connected IoT Devices

Number of global active IoT Connections (installed base) in Bn



Note: IoT Connections do not include any computers, laptops, fixed phones, cellphones or tablets. Counted are active nodes/devices or gateways that concentrate the end-sensors, not every sensor/actuator. Simple one-directional communications technology not considered (e.g., RFID, NFC). Wired includes Ethernet and Fieldbuses (e.g., connected industrial PLCs or I/O modules); Cellular includes 2G, 3G, 4G; LPWAN includes unlicensed and licensed low-power networks; WPAN includes Bluetooth, Zigbee, Z-Wave or similar; WLAN includes Wi-fi and related protocols; WNAN includes non-short range mesh; Other includes satellite and unclassified proprietary networks with any range.
Source: IoT Analytics Research 2018

NEXT-GENERATION IOT DEVICES



Source: <https://medium.com/dataseries/a-primer-on-edge-computing-3ef550c3d84e>

- Enable innovations across wide range of application domains
- Wireless and low power
- Complex system design tradeoffs: Performance, cost, form factor, and power consumption
- Heterogenous: mix of SW and HW
- Requires an interdisciplinary background in systems, software, hardware, and communication theory

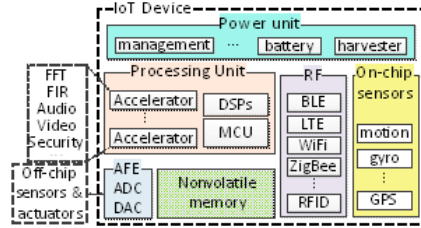
WES CURRICULUM

CS

Capstone Project

EE

Introduction to Embedded Systems

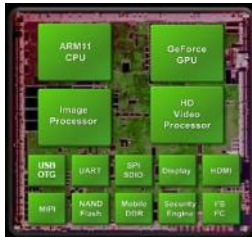


Software for Embedded Systems

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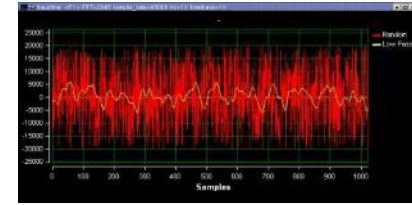
1 // C++ program to demonstrate the use of the
2 // C++ STL vector container.
3
4 #include <iostream>
5 #include <vector>
6
7 using namespace std;
8
9 int main()
10 {
11     // Create a vector of integers
12     vector<int> v;
13
14     // Add elements to the vector
15     v.push_back(10);
16     v.push_back(20);
17     v.push_back(30);
18     v.push_back(40);
19     v.push_back(50);
20
21     // Display the vector
22     for (int i = 0; i < v.size(); i++)
23         cout << v[i] << " ";
24
25     return 0;
26 }
    
```

Hardware for Embedded Systems

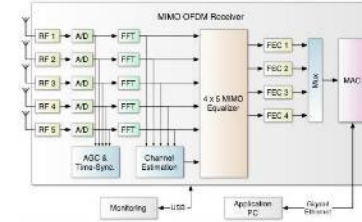


Validation and Prototyping of Embedded Systems

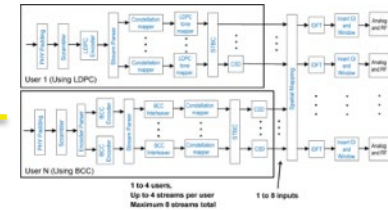
Digital Signal Processing



Digital Communication Systems



Wireless Communication Systems



WES CURRICULUM

Fall Year One	Winter Year One	Spring Year One	Summer Year One
Digital Signal Processing	Intro to Embedded Systems	Digital Signal Processing II	Software for Embedded Systems
Fall Year Two	Winter Year Two	Spring Year Two	
Digital Communication Systems I	Digital Communication Systems II	Capstone Project	
Hardware for Embedded Systems	Wireless Embedded Systems on a Chip		

ADMISSIONS GUIDELINES

- Bachelor's Degree in engineering, science, physics, mathematics, etc.
- 3.0 minimum GPA
- Statement of Purpose
- 3 Letters of Recommendation
- Resume
- No GRE



Yvonne Wu
yvwu@ucsd.edu



ARCHITECTURE-BASED ENTERPRISE SYSTEMS ENGINEERING LEADERSHIP PROGRAM

Faculty Director: Dr. Jon Wade

Develop “systems thinking” capabilities which incorporates enterprise landscape, enterprise stakeholders, and enterprise goals/missions

OVERVIEW

Faculty Director

Dr. Jon Wade – Professor of Practice in Mechanical and Aerospace Engineering

Intended Audience

Engineers with five+ years of relevant professional experience who are in a position to drive enterprise systems

Courses

1-year program (Sep 2023 – August 2024)

Alternating Fridays/Saturdays + 1 four-day workshop per quarter



Mechanical and
Aerospace Engineering
+
Rady School of
Management

INDUSTRY 4.0

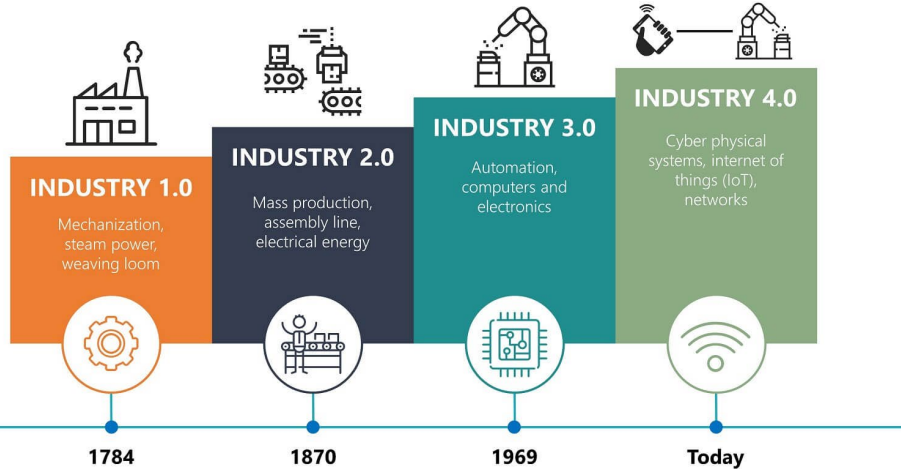


Image Credit: International Business Times

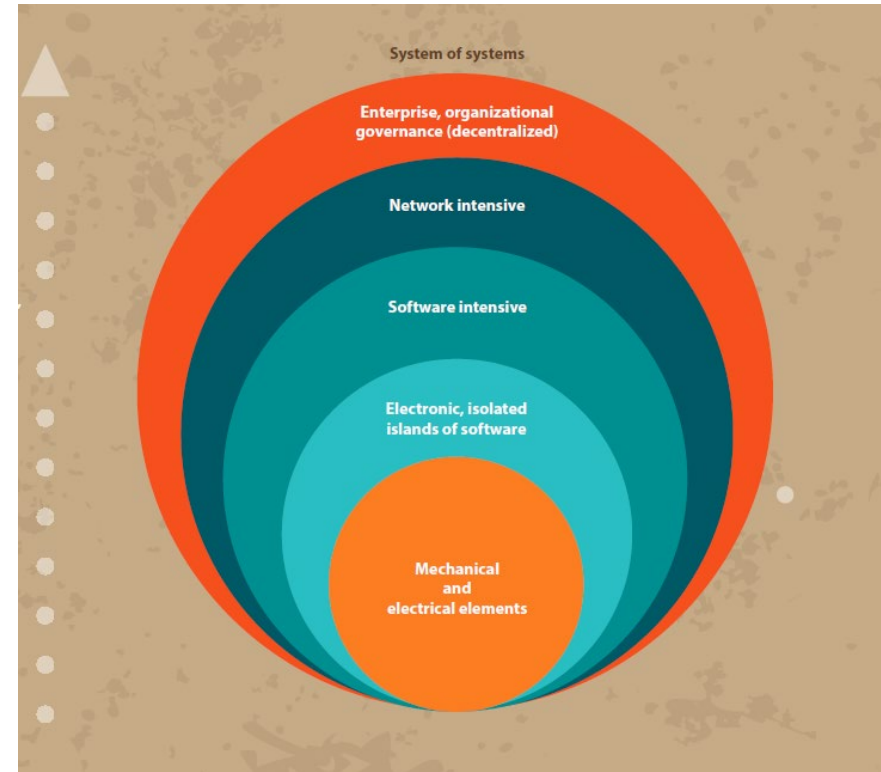
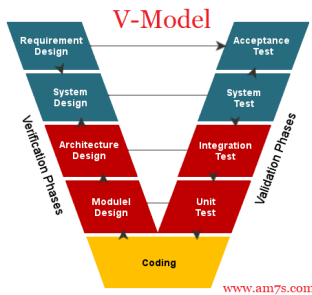
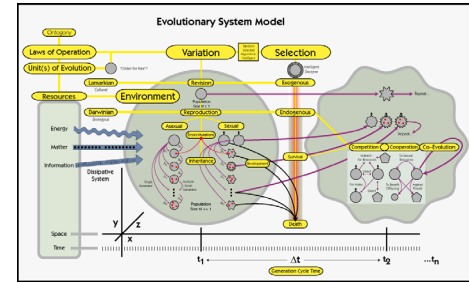


Image Credit: INCOSE Vision 2025



THE TRANSITION



From: Systems Engineering 1.0

- Systems built to last
- Opinion-based decision making
- Paper-based documentation
- Deeply integrated architectures
- Hierarchical organizational model
- Satisfying the requirements
- Phase-based Verification & Validation
- Separated Development and Operations

To: Systems Engineering 2.0

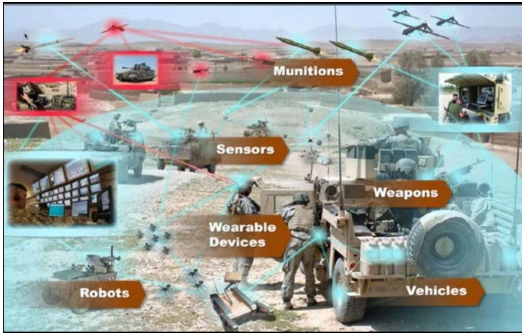
- Systems built to evolve
- Model and Data-driven decision making
- Model-based documents
- Modularized architectures
- Ecosystem of partners
- Constant experimentation and innovation
- Continuous Verification & Validation
- Integrated Development and Operations

THE POWER OF DIGITALIZATION: EXTRACTING VALUE FROM DATA

Exploiting the digital power of
computation, AI/ML, visualization and communication
to take better, faster actions



- Simulated data



- Experimental data

- Observed data

Dynamic
System
Validation

↑ Virtual
↓ Physical

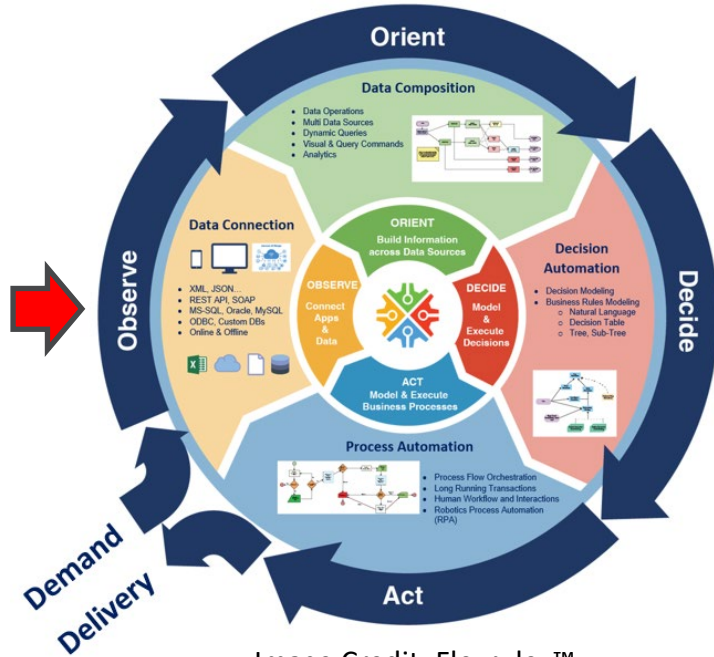
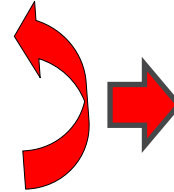


Image Credit: Flexrule TM

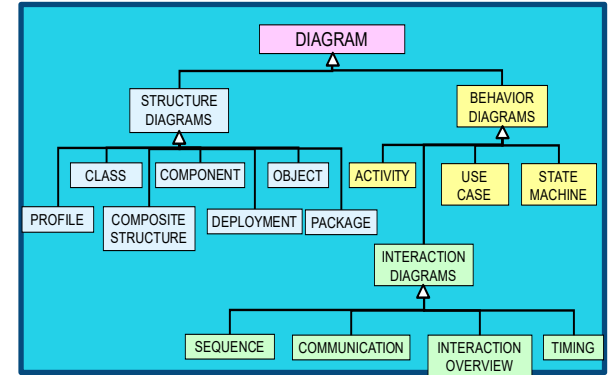
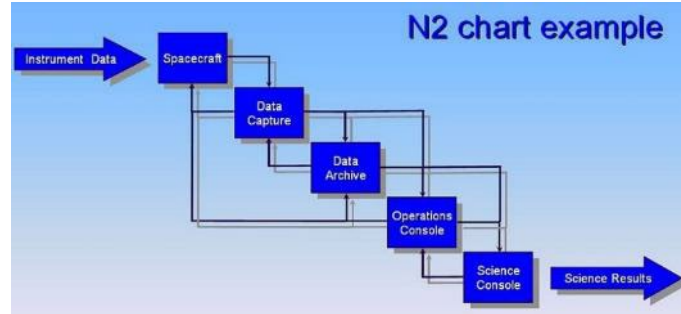
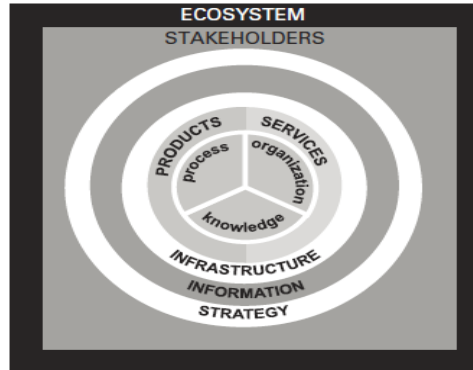


Rady School of Management

Architecture-Based Enterprise Systems Engineering Thinking & Leadership Program



Jacobs School of Engineering



“Information Age” Components

- Server farms
- The internet
- Digital capabilities
- Mobile devices
- Internet of Things (IoT)
- The Cloud
- Big data
- AI / machine learning...

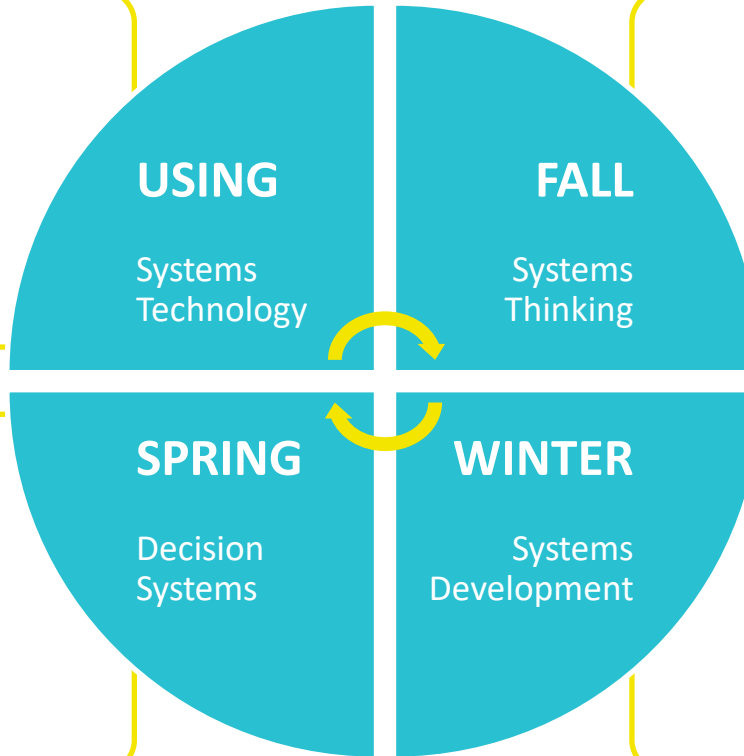
Systems
of
Systems



We focus on the **integration** of previously unconnected **systems** and **their interoperation** to accomplish previously unavailable tasks

AESE CURRICULUM

- Concept Maps
- Planning Tools (eg., NOV)
- Use Case Template
- SysML and UAF
- Data Analytics Tools
- Cybersecurity Tools



- Leadership
- Goals & Strategy
- Finance / Accounting
- Complex Systems
- Agile Development
- DevOps

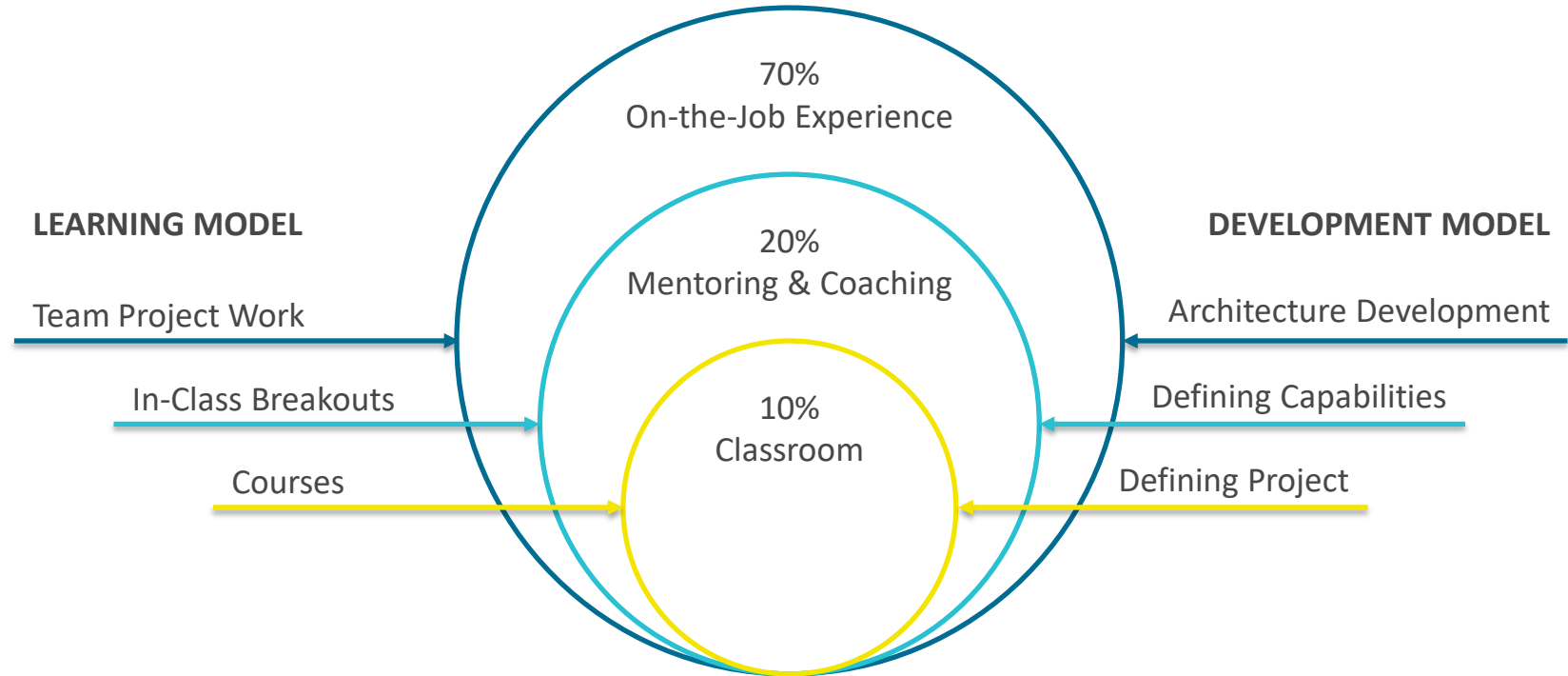
- MOPs and MOEs
- Event-driven Architectures
- Art of Decision Making
- Data Analytics
- Big Data and Deep Learning
- Investment Valuation and NOV
- Managing Stakeholder Relationships

- Enterprise Architectures
- Architecture Frameworks
- Use Cases/Capabilities
- Domain Modeling
- Service-Oriented Architecture
- SOA Governance
- Enterprise Cybersecurity
- Functional & Physical Architectures

Team Project: Fall - Summer

Enterprise systems and system-of-systems are necessarily complex adaptive systems. Development of complex adaptive systems stresses heuristics through synthesis rather than analysis. **Team projects are a major requirement for program completion.**

70:20:10 Models



DEVELOPING SYSTEMS THINKING CAPABILITIES?

- Understand Enterprise Landscape
- Involve Enterprise Stakeholders
- Define a Goal and Mission, including a strategy and operational concept
- Identify Desired Capabilities
 - Consider Different Alternatives To Achieve The Capabilities
 - Create Business Process Models/Use Cases
- Develop Architectural Models
 - Verify Logic, Behavior, and Performance of Models
 - Emphasize Events and Decision-making
- Iterate The Earlier Considerations Based On Experimentation and Experience
- Become Leaders and Team Builders

This is what we
do in AESE!

DELIVERY

- One-year program (September 2023 – August 2024)
 - Classes scheduled on alternating Fridays/Saturdays
 - One Wednesday – Saturday **workshop** per quarter
 - Class from 9:00a PT to 6:00p PT
 - Breakfast and lunch provided
- Classes offered **sequentially**
 - Three courses per quarter
 - One two-day **Team Project** meeting per quarter
- Each class has 32 contact hours (8 hours x 4 days)
- Final four-day Team Project / Capstone class at the end of August

ADMISSIONS GUIDELINES

- Bachelor's Degree in engineering, science, physics, mathematics, etc.
- 3.0 minimum undergraduate GPA
- Statement of Purpose
- 2 Letters of Recommendation
- Typically, 5 years of relevant work experience or equivalent
- Informative Resume
- No GRE



Stacey Williams

sdw008@ucsd.edu



DATA SCIENCE AND ENGINEERING

Faculty Directors: Dr. Ilkay Altintas and Dr. Alin Deutsch

Combine the skills of software programmer, database manager and statistician to create mathematical models of the data, identify trends, then present them in effective visual ways that can be understood by others.

OVERVIEW

Faculty Directors

Dr. Ilkay Altintas – Chief Data Science Officer, San Diego Supercomputer Center

Dr. Alin Deutsch – Professor of Computer Science and Engineering

Intended Audience

Engineering professionals with a background in computer science or other engineering or mathematics with substantial experience in data analysis.

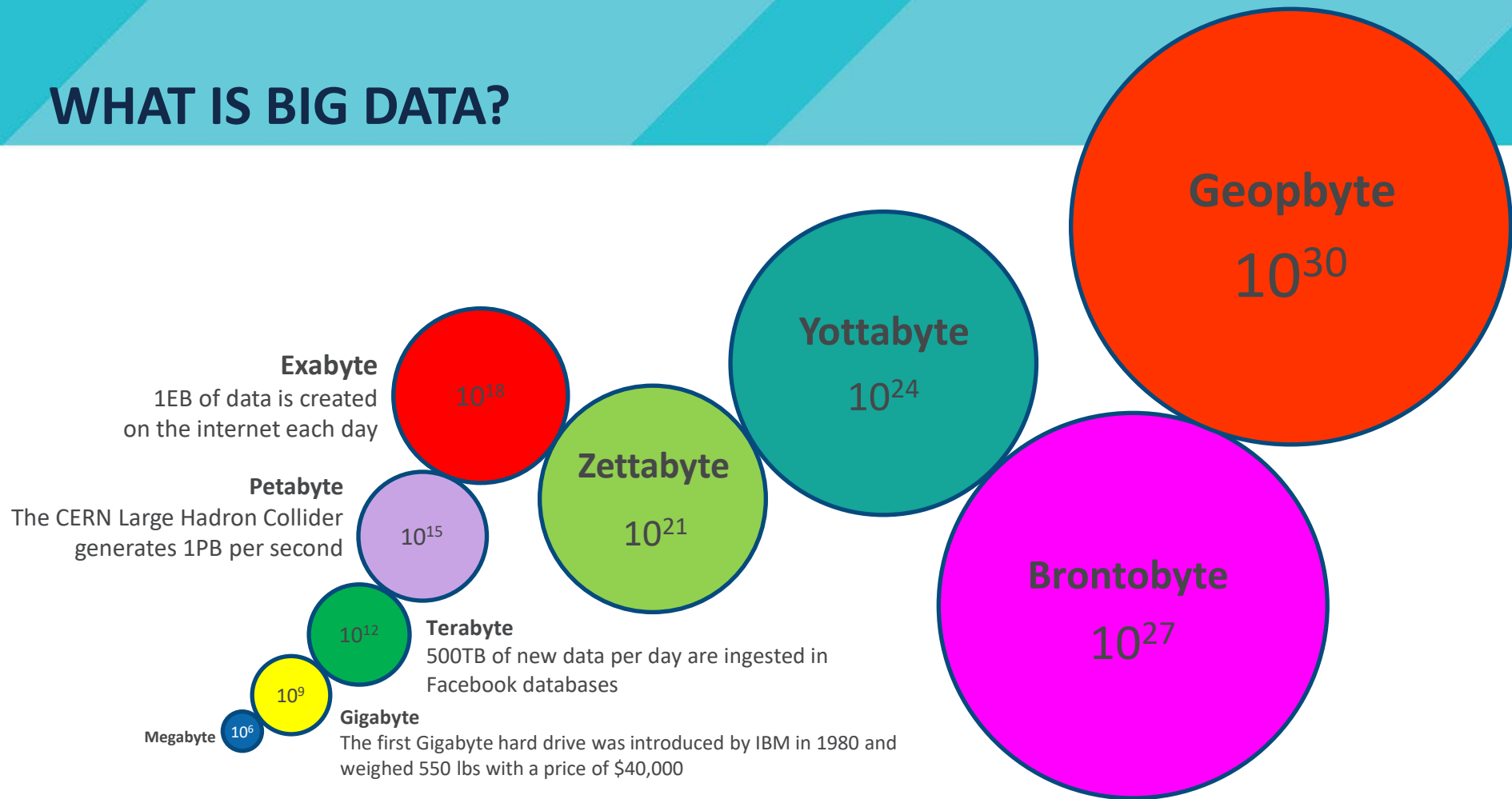
Courses

2-year program (Sep 2023 – June 2025) with classes on alternating Fridays and Saturdays

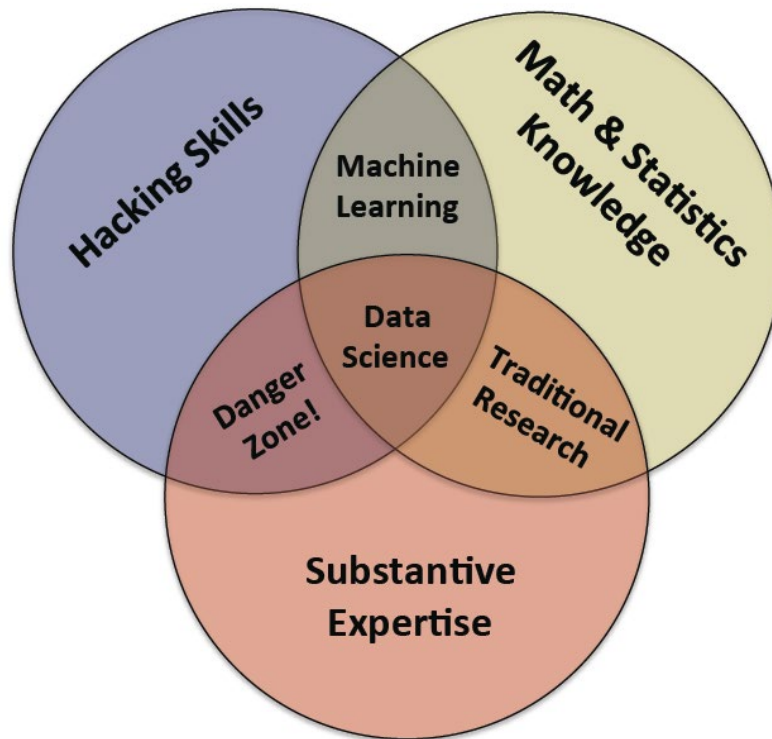


Computer Science and
Engineering
+
San Diego
Supercomputer Center

WHAT IS BIG DATA?



THE EDUCATION OF A DATA SCIENTIST



DSE COURSEWORK

Fall Year One

DSE 200: Python for Data Analysis
(4 units)

DSE 290: Case studies in Data
Science (2 units)

Winter Year One

DSE 201: Data Management Systems
(4 units)

DSE 210: Probability and Statistics
for Data Science (4 units)

Spring Year One

DSE 220: Machine Learning (4 units)

DSE 230: Scalable Data Analysis
(4 Units)



CASE STUDIES

Fall Year Two

DSE 203: Data Integration & ETL
(4 units)

DSE 250: Beyond Relational Data
Models (4 units)

Winter Year Two

DSE 241: Data Visualization
(4 units)

DSE 260A: Data Science Design
Capstone Project (2 units)

Spring Year Two

DSE 260B: Data Science Design
Capstone Project (2 units)

ADMISSIONS GUIDELINES

- Bachelor's Degree in engineering, science, physics, mathematics, etc.
- 3.0 minimum GPA
- Statement of Purpose
- 2 Letters of Recommendation (3 preferred)
- Resume
- No GRE



Yvonne Wu
yvwu@ucsd.edu

ADDITIONAL GUIDELINES

MAJOR Importance (at least 2/3)

1. Programming experience in a general-purpose language (C, Java, Python)
2. Experience with databases/SQL
3. Experience with data analysis in an application domain

MINOR Importance (strengthens your application)

1. Math: linear algebra, probability and statistics
2. Distributed Systems: Hadoop, Spark...

The background features a photograph of a modern, multi-story building with a mix of concrete and glass facades. The image is heavily stylized with a semi-transparent blue overlay and several thick, diagonal blue stripes that cross the entire frame. Centered over this background is the text "NEXT STEPS" in a bold, yellow, sans-serif font.

NEXT STEPS

NEXT STEPS FOR ALL PROGRAMS

For more information

JacobsSchool.ucsd.edu/MAS

Applications

Accepting Applications Now!

Applications are reviewed in the order received.

Next application review deadline: April 5th

More questions?

Contact Yvonne Wu or Stacey Williams



Yvonne Wu

Program Manager,
DSE and WES

yvwu@ucsd.edu



Stacey Williams

Program Manager,
AESE

sdw008@ucsd.edu

The background features a photograph of a modern, multi-story building with a glass facade and balconies. The image is overlaid with a semi-transparent blue filter and two prominent diagonal stripes in a slightly darker shade of blue. Centered over this background is the text "Q&A IN BREAKOUT ROOMS" in a bold, yellow, sans-serif font.

Q&A IN BREAKOUT ROOMS



THANK YOU!

[JACOBSSCHOOL.UCSD.EDU/MAS](https://jacobsschool.ucsd.edu/mas)

Wednesday, April 5, 2023

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JACOBS SCHOOL OF ENGINEERING
Executive Education