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DSC 498
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Data Science Capstone Proposals

September 23rd, 2020

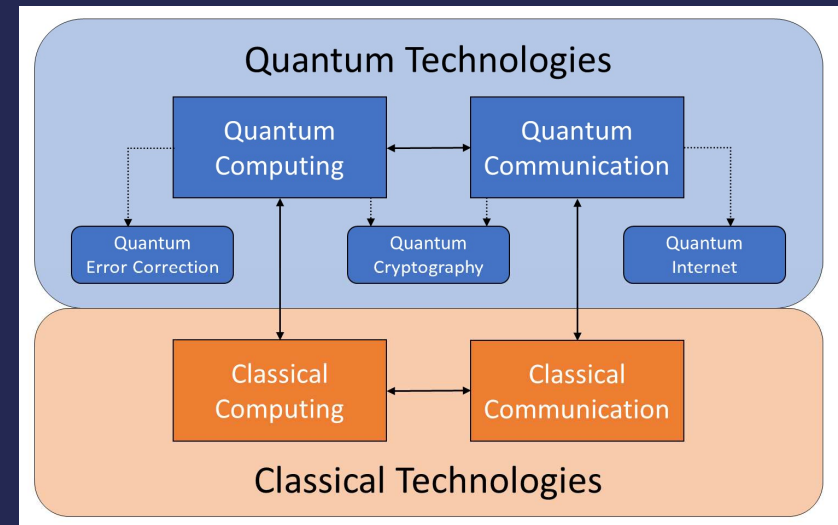
Data Science Capstone Proposals

- Quantum Tech. Survey
- Raw Image Scanner
- MIPS Decompiler
- Rules Analyst
- Socialization Helper
- Help-A-Professor
- Resources and Challenges

Quantum Tech. Survey

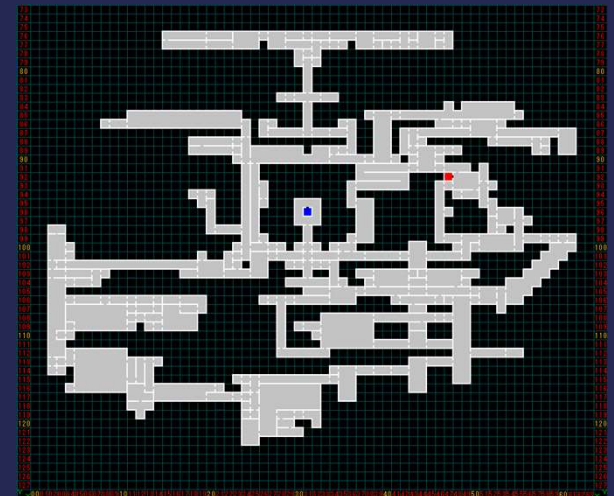
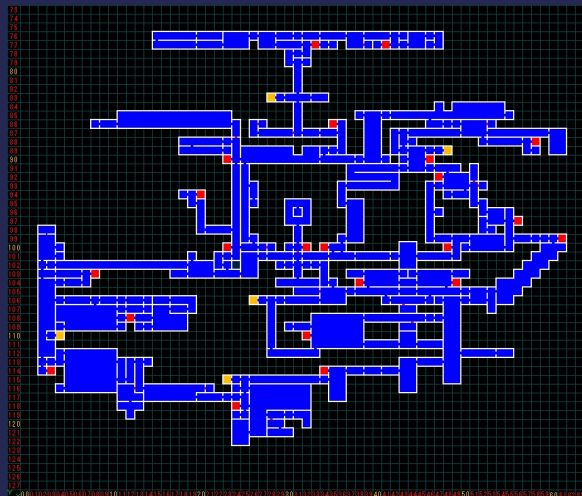
- Collect details on published research on quantum technologies (IEEE, commercial, etc.)
- Harmonize data set for analysis: contributors, dates, tags, etc.
- Determine high-focus areas based on time, region, methods, impact factor, industry

Document Title	Authors	Author Affiliations	Publication Title
Generalized and Differential Likelihood Ratio Tests with Quantum Signal	S. Yan; R. Malaney; J. Yuan	School of Engineering, Macquarie University	2019 IEEE International Conference on Quantum Science and Technology
Extending Gradient Echo Memory Using Machine Learning and Single Photon	A. Leung; A. Tranter; K. Paul; J. Everett; P. V.	Department of Quantum Science, University of Queensland	2018 Conference on Lasers and Electro-Optics and 2018 Optical Fiber Communication Conference
Mechanical Fault Diagnosis Method Based on Machine Learning	Z. Nan	Handan Vocational & Technical College	2015 Seventh International Conference on Machine Learning and Applications
Infinite probabilistic latent component analysis for audio source separation	K. Yoshii; E. Nakamura; K. Itoyama; M. Goto	Kyoto University; Kyoto University	2017 IEEE 27th International Workshop on Machine Learning in Signal Processing
Compositional Modeling of Partial Discharge Pulse Spectral Characteristics	P. C. Baker; B. Stephen; M. D. Judd	Institute for Energy and Environment, University of Queensland	IEEE Transactions on Instrumentation and Measurement
Security Verification of Artificial Neural Networks Used to Error Correct	M. Niemiec; M. Mehic; M. Voznak	VSB-Technical University of Ostrava	2018 26th Telecommunications Forum (TELFOR)
A Discrimination Based Artificial Immune System for Classification	K. Igawa; H. Ohashi	University of Tokyo; Department of Quantum Science	2018 International Conference on Quantum Computing and Communications
Ensemble Method for Privacy-Preserving Logistic Regression Based on Homomorphic Encryption	H. J. H. Cheon; D. Kim; Y. Kim; Y. Song	Department of Mathematical Sciences, Seoul National University	IEEE Access
Constructions of quantum BCH codes based on finite fields of odd characteristic	Y. Gao; Y. Xiao; Y. Tao	College of Sciences, Civil Aviation University of China	2010 International Conference on Quantum Computing and Communications
Free Electron Qubits	O. Reinhardt; C. Meichel; M. Lynch; I. Kaminer	Technion-Israel Institute of Technology	2019 Conference on Lasers and Electro-Optics and 2019 Optical Fiber Communication Conference
Meta-learning within Projective Simulation	A. Makmal; A. A. Melnikov; V. Dunjko; H. J. I.	Institute for Theoretical Physics, University of Vienna	IEEE Access
Text categorization by fuzzy domain adaptation	V. Behbood; J. Lu; G. Zhang	Decision Systems & E-Service, University of Melbourne	2013 IEEE International Conference on Data Mining
Self-adaptive chaos quantum clonal evolutionary programming	Yangyang Li; Licheng Jiao; Fang Liu	Institute of Intelligent Information Processing, Chinese Academy of Sciences	7th International Conference on Quantum Computing and Communications
Probabilistic Transfer Factor Analysis for Machinery Autonomous Diagnosis	J. Wang; R. Zhao; R. X. Gao	School of Safety and Ocean Engineering, Shanghai Jiao Tong University	IEEE Transactions on Instrumentation and Measurement
Probabilistic Computing with Binary Stochastic Neurons	A. Z. Pervaiz; S. Datta; K. Y. Camsari	Purdue University, School of Electrical and Computer Engineering	2019 IEEE BiCMOS and Compound Semiconductor Integrated Circuits and Systems Conference
Quantum Computation in Robotic Science and Applications	C. Petschnigg; M. Brandstätter; H. Pichler	JOANNEUM RESEARCH, Institute of Information Technology	2019 International Conference on Quantum Computing and Communications
Improving the Accuracy of Low Level Density Functional Theory Calculations	T. Gao; D. Pu; H. Li; Y. Lu; H. Li; Z. Su	School of Computer Science and Information Technology, Beijing University of Aeronautics and Astronautics	2010 International Conference on Quantum Computing and Communications
Evolution of Quantum Computing Based on Grover's Search Algorithm	P. Shrivastava; K. K. Soni; A. Rasool	Computer Science Engineering, Indian Institute of Technology	2010 International Conference on Quantum Computing and Communications
Network Representation Learning: A Survey	D. Zhang; J. Yin; X. Zhu; C. Zhang	Centre for Artificial Intelligence, University of Hong Kong	IEEE Transactions on Big Data
Fast tracking of hidden objects with single-pixel detectors	S. Chan; R. E. Warburton; G. Garipey; Y. Altun	Institute of Photonics and Quantum Electronics, University of Basel	Letters
Robust supervised learning based on tensor network method	Y. W. Chen; K. Guo; Y. Pan	Institute of Cyber-Systems and Robotics, University of Tokyo	2018 33rd Youth Academic Annual Meeting of the Chinese Association of Quantum Optics
Self-Tuning Fiber Lasers	S. L. Branton; X. Fu; J. N. Kutz	Department of Applied Mathematics, University of Cambridge	Journal of Selected Topics in Quantum Electronics
Signature Infrared Bacteria Spectra Analyzed by an Advanced Integrative	S. Ji; D. H. Jeong; M. Hassan; I. K. Ilev	Department of Computer Science, University of Cambridge	Journal of Selected Topics in Quantum Electronics
An Efficient Algorithm to Compute a Quantum Probability Space	M. Melucci	University of Padua, Padua	IEEE Transactions on Knowledge and Data Engineering
A Study on GPS GDOP Approximation Using Support-Vector Machines	C. Wu; W. Su; Y. Ho	Department of Electrical Engineering, National Tsing Hua University	IEEE Transactions on Instrumentation and Measurement
A Development of Fuzzy Encoding and Decoding Through Fuzzy Clustering	W. Pedrycz; J. Valente de Oliveira	University of Alberta, Edmonton	IEEE Transactions on Instrumentation and Measurement
Diagnosis of Neuromuscular Disorders Using DT-CWT and Rotation Forest	A. Subasi	Electromyographic (EMG) Signals, University of Istanbul	IEEE Transactions on Instrumentation and Measurement
Deep Abstraction and Weighted Feature Selection for Wi-Fi Impersonation	M. E. Aminanto; R. Choi; H. C. Tanuwidjaja	School of Computing, Korea Advanced Institute of Science and Technology	IEEE Transactions on Information Forensics and Security
Inductive User Preference Manipulation for Multimedia Retrieval	D. Zellhöfer	Database & Information Systems Group, University of Bayreuth	2010 Second International Conference on Quantum Computing and Communications
Quantum Photonic Neural Networks	G. R. Steinbrecher; J. P. Olson; D. Englund	Research Laboratory of Electronics, Massachusetts Institute of Technology	2019 Conference on Lasers and Electro-Optics and 2019 Optical Fiber Communication Conference
Toward the Optimization of Normalized Graph Laplacian	B. Xie; M. Wang; D. Tao	Nanyang Technological University	IEEE Transactions on Neural Networks and Learning Systems
Machine Learning Optimization of Surface-Normal Optical Modulators	S. Bianconi; S. Wheaton; M. Park; I. Hassani	Department of Electrical Engineering, University of California	IEEE Journal of Selected Topics in Quantum Electronics
A Probabilistic Graphical Model of Quantum Systems	C. Yeang	Institute of Statistical Science, Academia Sinica	2010 Ninth International Conference on Quantum Computing and Communications



Raw Image Scanner

- Create system that accepts an image as a template and compares it to a camera image
- Include generating text lists or tables, filling templates, or highlighting differences
- Provide image correction for flawed camera images



MIPS Decompiler

- Convert MIPS Assembly language code into popular modern languages
- Revert decompiled or modified code back into MIPS Assembly
- Examine compatibility with use on modern hardware

The screenshot displays the MIPS Decompiler application interface, which is divided into several sections:

- MIPS Assembly:** A text area on the left containing MIPS assembly code, such as `[0x00185E94] lui r3,0x8019` and `[0x00185E98] lbu r3,0x38d8(r3)`.
- Hex Encoding:** A section on the right showing the corresponding hexadecimal values for the assembly instructions, such as `1980033C` and `D8386390`.
- Controls:** A central panel with buttons for `Encode >>` and `<< Decode`, a `Show Addresses` checkbox, a `Starting address` input field (set to `0x00185e94`), a `Little Endian` checkbox, a `Pad (spaces)` checkbox, a `Number:` input field, and a `Name Registers` checkbox.
- Output:** A large text area on the right displaying the decompiled C# code. This includes error handling for out-of-bounds access and two public methods: `public short loadHalf(int startAddress)` and `public int loadWord(int startAddress)`, which use bitwise operations to extract data from a byte array.

Rules Analyst

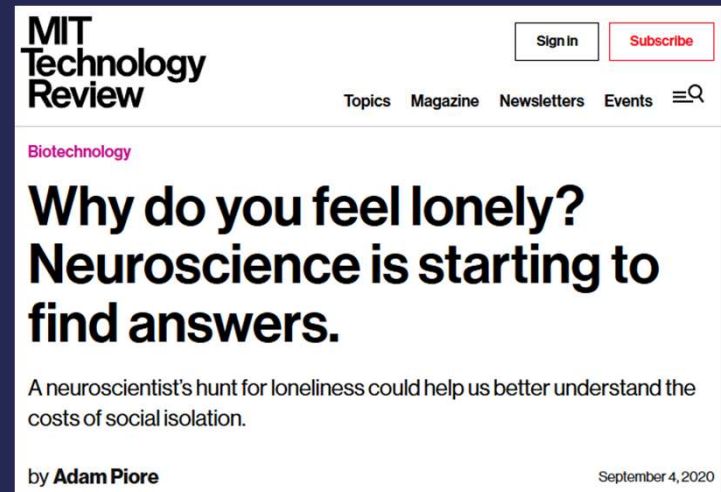
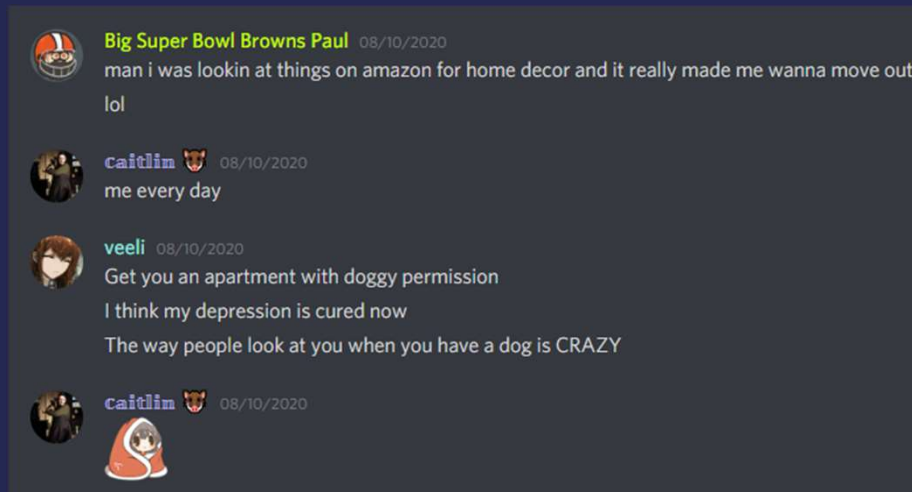
- Interpret rulesets of various sports or games from source rulebooks through text parsing
- Create model for ML using supervised/unsupervised learning
- Determine impact of rule changes in style of professional-level play

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1	Name	Season	Team	Pos	GP	G	A	P	PIM	PIM/GP	TOI/GP	PIM/TOI%	Pen Drawn	Pen Taken	Net Pen	Pen Drawn/60	Pen Taken/60	Net Pen/60	Minor	Major	Match	Mst	G Mst
2	Evander Kane	2019/2020	SJS	L	64	26	21	47	122	1:54	19:32	9.8	18	38	-20	0.86	1.82	-0.96	30	4	0	3	1
3	Brendan Lemieux	2019/2020	NYR	L	59	6	12	18	111	1:52	12:52	14.6	32	28	4	2.53	2.21	0.32	18	5	0	5	0
4	Brady Tkachuk	2019/2020	OTT	L	71	21	23	44	106	1:29	18:56	7.9	47	35	12	2.1	1.56	0.54	28	4	0	3	0
5	Brenden Dillon	2019/2020	SJS,WSH	D	69	1	13	14	104	1:30	19:27	7.8	17	38	-21	0.76	1.7	-0.94	32	4	0	2	0
6	Barclay Goodrow	2019/2020	SJS,TBL	C	70	8	18	26	97	1:23	15:55	8.7	26	29	-3	1.4	1.56	-0.16	21	5	0	3	0
7	Nick Ritchie	2019/2020	ANA,BOS	L	48	9	12	21	97	2:01	14:08	14.3	2	27	-25	0.18	2.39	-2.21	21	1	0	3	2
8	Nazem Kadri	2019/2020	COL	C	51	19	17	36	97	1:54	17:25	10.9	24	31	-7	1.62	2.09	-0.47	25	3	0	3	0
9	Erik Gudbranson	2019/2020	PIT,ANA	D	51	4	5	9	95	1:51	19:21	9.6	10	23	-13	0.61	1.4	-0.79	15	3	0	5	0
10	Tom Wilson	2019/2020	WSH	R	68	21	23	44	93	1:22	18:16	7.5	30	35	-5	1.45	1.69	-0.24	29	5	0	1	0
11	Nicolas Deslauriers	2019/2020	ANA	L	59	7	6	13	92	1:33	9:46	15.9	17	21	-4	1.77	2.18	-0.42	6	14	0	1	0
12	Brad Marchand	2019/2020	BOS	L	70	28	59	87	82	1:10	19:27	6	45	33	12	1.98	1.45	0.53	30	2	0	1	0
13	P.K. Subban	2019/2020	NJD	D	68	7	11	18	79	1:09	22:07	5.3	13	30	-17	0.52	1.2	-0.68	27	1	0	2	0
14	Garnet Hathaway	2019/2020	WSH	R	66	9	7	16	79	1:11	10:46	11.1	36	24	12	3.04	2.02	1.01	17	5	1	1	0
15	Ross Johnston	2019/2020	NYI	L	32	3	1	4	78	2:26	7:59	30.5	12	18	-6	2.82	4.23	-1.41	9	6	0	3	0
16	John Hayden	2019/2020	NJD	C	43	3	1	4	77	1:47	9:42	18.4	10	19	-9	1.44	2.73	-1.29	11	5	0	2	1
17	Matthew Tkachuk	2019/2020	CGY	L	69	23	38	61	74	1:04	18:18	5.9	34	23	11	1.61	1.09	0.52	17	4	0	2	0
18	Joel Edmundson	2019/2020	CAR	D	68	7	13	20	72	1:03	18:26	5.7	16	29	-13	0.77	1.39	-0.62	26	2	0	1	0
19	Pat Maroon	2019/2020	TBL	L	64	9	14	23	71	1:06	12:24	8.9	17	20	-3	1.28	1.51	-0.23	13	5	0	2	0
20	Brendan Smith	2019/2020	NYR	D	62	3	5	8	71	1:08	11:06	10.3	17	20	-3	1.48	1.74	-0.26	13	5	0	1	1
21	Corey Perry	2019/2020	DAL	R	57	5	16	21	70	1:13	13:43	9	18	24	-6	1.38	1.84	-0.46	20	2	0	1	1
22	Ryan Hartman	2019/2020	MIN	R	69	9	11	20	69	1:00	12:15	8.2	23	26	-3	1.63	1.84	-0.21	22	3	0	0	1
23	Zack Kassian	2019/2020	EDM	R	59	15	19	34	69	1:10	15:39	7.5	10	22	-12	0.65	1.43	-0.78	17	3	0	2	0
24	Kyle Clifford	2019/2020	LAK,TOR	L	69	7	10	17	68	0:59	11:11	8.8	16	20	-4	1.24	1.55	-0.31	13	6	0	0	1
25	Wayne Simmonds	2019/2020	NJD,BUF	R	68	8	17	25	66	0:58	14:55	6.5	13	22	-9	0.77	1.3	-0.53	18	2	0	1	1
26	Nikita Zadorov	2019/2020	COL	D	64	4	9	13	65	1:00	17:46	5.7	9	27	-18	0.47	1.42	-0.95	25	1	0	1	0
27	Austin Watson	2019/2020	NSH	L	53	6	8	14	65	1:13	11:37	10.6	13	18	-5	1.27	1.75	-0.49	10	7	0	1	0
28	Alexander Edler	2019/2020	VAN	D	59	5	28	33	62	1:03	22:37	4.7	13	27	-14	0.58	1.21	-0.63	26	0	0	1	0
29	Nick Foligno	2019/2020	CBJ	L	67	10	21	31	62	0:55	18:40	5	12	21	-9	0.58	1.01	-0.43	16	4	0	0	1
30	Ben Chiarot	2019/2020	MTL	D	69	9	12	21	61	0:53	23:08	3.8	6	25	-19	0.23	0.94	-0.71	23	1	0	1	0
31	Jacob Trouba	2019/2020	NYR	D	70	7	20	27	61	0:52	22:33	3.9	18	22	-4	0.68	0.84	-0.15	18	3	0	0	1
32	Zdeno Chara	2019/2020	BOS	D	68	5	9	14	60	0:52	21:00	4.2	14	23	-9	0.59	0.97	-0.38	19	4	0	0	0

SECTION 4 – TYPES OF PENALTIES	
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Rule 15 – Calling of Penalties	
15.1 Calling a Penalty - Should an infraction of the rules which would call for a minor, major, misconduct, game misconduct or match penalty be committed by a player of the side in control of the puck, the Referee shall immediately blow his whistle and penalize the offending player.	
Should an infraction of the rules which would call for a minor, major, misconduct, game misconduct or match penalty be committed by a player of the team not in control of the puck, the Referee shall raise his arm to signal the delayed calling of a penalty. When the team to be penalized gains control of the puck, the Referee will blow his whistle to stop play and impose the penalty on the offending player.	
When a player, Trainer, Manager, coach or non-playing Club personnel is ejected from the game for a violation of the playing rules, that individual must vacate the players' bench area and may not, in any manner, further participate in the game. This includes directing the team from the spectator area or by radio communications. Any violations shall be reported to the Commissioner.	
Refer to Reference Tables – Table 1 – Summary of Penalties to Coaches and Non-playing Club Personnel (page 138) for a list of infractions specific to those individuals.	

Socialization Helper

- Create platform to encourage online interaction among friends/family
- Analyze usage habits to help users deal with loneliness and depression
- Devise security and privacy methods to deter improper use



Help-A-Professor

- Dean of CAS Prof. Pauline Entin and Prof. Shannon Jenkins:
 - Comparing online vs. in-person learning methods
- Prof. Keivan Sadeghzadeh:
 - Predictive Models for Preventable Readmission for Mental Patients Using Socioeconomic Disadvantages [Ongoing Project]
 - Detecting and Predicting Medical Errors in Cancer Screening Process [New Project]
 - Mental Health Service Supply and Demand in the Post-Pandemic Healthcare [New Project]



Entin (top-left);
Jenkins (bottom-left);
Sadeghzadeh (right).

Resources and Challenges

- Resources:
 - HTML parsing for web data, Optical Character Recognition (OCR)
 - R, MATLAB, Python, Java, C++, SQL, Assembly language tools as needed
 - Viewers like you!
- Challenges:
 - Machine learning methods in Spring 2021
 - Artificial intelligence methods TBA
 - Physical limitations during pandemic