THE UNIVERSITY OF BRITISH COLUMBIA

REPORT TO THE BOARD OF GOVERNORS

SUBJECT	**TUITION | MASTER OF DATA SCIENCE IN COMPUTATIONAL LINGUISTICS**
MEETING DATE	**JUNE 14, 2018**

Forwarded to the Board of Governors on the Recommendation of the President

APPROVED FOR SUBMISSION

Santa J. Ono, President and Vice-Chancellor

DECISION REQUESTED	**IT IS HEREBY REQUESTED that *the UBC Board of Governors approve proposed tuition of $10,404.00 per instalment for domestic students and $14,145.33 per instalment for international students for the new Master of Data Science – Computational Linguistics (MDS-CL) program, with a minimum of three instalments.***
Report Date	April 27, 2018
Presented By	Andrew Szeri, Provost and Vice-President Academic Hugh Brock, Associate Provost Academic Innovation Simon Peacock, Dean, Faculty of Science

EXECUTIVE SUMMARY

The Master of Data Science in Computational Linguistics program is a 10-month, program-based, on-premise professional program that will provide students with knowledge and techniques for extracting knowledge from linguistic data. Graduates will be positioned to fill the demand for computational linguists across a range of fields. This is a cost-recovery program.

Proposed program tuition is $10,404.00 per instalment for domestic students and $14,145.33 per instalment for international students, assessed over three instalments, to be consistent with the existing Master of Data Science program approved by the Board, subject to annual increases as established by the university. The Master of Data Science in Computational Linguistics program will be effective 2019 Winter Session. On acceptance into the program, students will be required to pay a $3,000 non-refundable acceptance deposit to be applied towards their first tuition instalment. Tuition and fee details are included in Appendix 1.

INSTITUTIONAL STRATEGIC PRIORITIES SUPPORTED

✔ **Learning** ☐ **Research** ☐ **Innovation** ✔ **Engagement (Internal / External)** ✔ **International**

or ☐ **Operational**

DESCRIPTION & RATIONALE

As the overall field of data science continues to grow, software developers trained specifically in working with complex language data are quickly becoming critical to the success of global businesses, and these businesses are competing to attract employees qualified to address their needs.

This trend holds at all levels of industry, including the highest levels: for example, five of the ten most valuable companies in the world today—Alphabet (Google's parent company), Facebook, Amazon.com, Microsoft and Apple—all operate at the intersection between language and computation, whether via search engines, discourse analysis of social media, machine translation, or summary. As the field of computational linguistics continues to grow as a key part of the global information economy, the utility of many of the existing tools developed for resource-rich languages like English and Mandarin Chinese is driving creation of new tools in these languages, and the extension of existing tools to other languages. This new development is increasingly dependent on experts with crossover knowledge between computation and linguistics.

The M.D.S.–C.L. will graduate students with the skills and perspectives necessary to solve significant problems for government and industry, using the cutting-edge combination of linguistics and computational applications. Computational linguistics is a growth area within a growth area: the employment outlook for software designers is strong in BC and many other areas, and the field is projected to continue to grow for at least the next 10 years (US projections anticipate a 17% increase, to over 1 million jobs, during this period); and as the overall field continues to grow, multiple sources indicate that specialization in computational linguistics will continue to be a leading growth area within the field.

BENEFITS
Learning, Research, Financial, Sustainability & Reputational

The Master of Data Science - Computational Linguistics extends the reach of the highly successful M.D.S. degree. There are no professional programs in computational linguistics in British Columbia or in Canada. There is a strong need to extract meaning from the vast amount of text generated in social media and within public and private organizations in order to predict trends and direct decision making. This program is cost-recovery and will capitalize on the success of the M.D.S., continuing to solidify B.C. as a leader in artificial intelligence and data analysis.

As a training program for students with a background in Language, M.D.S.–C.L. will graduate students with both strong subject area knowledge and strong statistical knowledge.

The strong rankings of UBC in Linguistics, Computer Science and Statistics makes UBC particularly well-placed to capitalize on these trends. Similar successful programs in the US include Carnegie Mellon and the U. of Washington.

RISKS
Financial, Operational & Reputational

There is a financial risk of not recouping investments made in the setup and marketing of the program. We have attempted to mitigate this risk through assessments of market demand of the program. The program has been designed based on input from local industry leaders. The market has been assessed through surveys of UBC undergraduates and alumni.

COSTS

The program is cost recovery.

FINANCIAL
Funding Sources, Impact on Liquidity

Proposed program tuition is $10,404 per instalment for domestic students and $14,145.33 per instalment for international students, assessed over three instalments, to be consistent with the existing Master of Data Science program approved by the Board, subject to annual increases as established by the university. The Master of Data Science in Computational Linguistics program will be effective 2019 Winter Session. On acceptance into the program, students will be required to pay a $3,000 non-refundable acceptance deposit to be applied towards their first tuition instalment. Tuition and fee details are included in Appendix 1.

The tuition was set based on an analysis of the tuition of programs in the area of Computational Linguistics in the US and Canada relative to the reputation of the institution offering the program.

For the first five years of the program, 5% of the adjusted revenue is set aside for student financial aid; at year six, 4% of the adjusted revenue is set aside for student financial aid.

SCHEDULE
Implementation Timeline

The program is to launch in September 2019.

CONSULTATION
Relevant Units, Internal & External Constituencies

A survey of Linguistics and Cognitive Systems alumni (12% response rate from 340 invitations) revealed:

- 41% have since completed additional courses in the field of computer science
- 66% are likely or very likely to recommend UBC as a provider of such a program
- 62% would consider enrolling in such a program, or are currently enrolled at another institution

In line with student comments, the Master's programme was tailored for those with minimal programing experience and designed to given them the skills most desired by industry.

In addition to student surveys, the department conducted employment market research to help assess the demand for the proposed program, including an examination of student interest and employability in industry, and consultations with other higher education institutions offering similar programs:

- We consulted individuals from a variety of organizations in the tech industry, including Amazon, BuildDirect, CapGemini and Druide informatique. Their feedback led to the current emphasis on natural language processing, machine learning, big data, statistics and an understanding of the fundamentals of programming as core competencies.
- We created a program that searched job postings on indeed.ca and indeed.com using the following keywords: Natural language processing, NLP, Natural language, Computational linguistics. On a single day (July 16, 2016), this scraper found 133 job postings on indeed.ca and 1876 postings on indeed.com.

- A market analysis performed for Brandeis University by the Education Advisory Board in 2014 also found a strong labour market outlook for computational linguists.

The creation of the Master of Data Science – Computational Linguistics has occurred with much encouragement from other institutions with existing master's programs in computational linguistics. The sense among institutions that are offering master's programs in computational linguistics is that the number of trained graduates needed is so large that any new degree programs represent not competition, but rather a means to help satisfy the burgeoning demand for graduates. This has inspired not only encouragement, but also active collaboration. For example, Carnegie Mellon University has offered to share both pedagogical software and server space with UBC, and U. Washington has created an email group to help institutions collaborate with each other.

Appendix – Program Tuition and Fee Assessment Details

Program Description: Master of Data Science in Computational Linguistics

Start Date of the Program: September 2019

For the first five years of the program, 5% of the adjusted revenue is set aside for student financial aid; at year six, 4% of the adjusted revenue is set aside for student financial aid.

	Domestic	**International**
Tuition fees per instalment – Note 1	$10,404.00	$14,145.33
Minimum No. of Instalments	3	3
Continuing Fees per Instalment (assessed after 3 instalments) – Note 1	$745.89	$2,868.22
Application Fees (Graduate) – Note 2	$104.00	$168.25
Non-Refundable Acceptance Deposit – Note 3	$3,000.00	$3,000.00

Note 1 – These are the current tuition rates for the Master of Data Science program for the 2018 Winter session and are subject to annual increases as established by the university. Tuition and student fees are charged in three equal instalments payable in January, May and September.

Note 2 – This is the current fee for the 2019W application cycle and is subject to annual increases.

Note 3 – The non-refundable acceptance deposit will be applied towards the first tuition instalment.

MASTER OF DATA SCIENCE – COMPUTATIONAL LINGUISTICS
STUDENT TUITION CONSULTATION REPORT

The Vice-President Students Office, in partnership with the Faculty of Science and the Faculty of Arts, conducted a student consultation regarding the tuition proposal for the new Master of Data Science – Computational Linguistics. This report outlines the consultation process and summarizes student feedback including the student representatives' submission verbatim in Appendix 2.

Student Representative Bodies Invited to the Consultation

- Alma Mater Society (AMS)
- Graduate Student Society (GSS)

Mode of Consultation

The consultation consisted of an e-consultation and a face-to-face meeting. Student representative groups were invited to the consultation through email, and asked to distribute the invitation to their constituents as they felt appropriate. Student representative groups were also offered a face-to-face meeting to discuss the tuition proposal. A meeting was not requested by student representatives.

Basis of Consultation: The consultation was based on a tuition proposal and rationale document created by the Faculty. Please see Appendix 1 for the invitation and tuition rationale document.

Timelines: The e-consultation was conducted over the period of April 12th, 2018 to May 14th, 2018.

Summary of Student Feedback: A submission was received from the AMS. The verbatim submission is in Appendix 2.

Organization	Summary
AMS Submission	**SUPPORT FOR PROGRAM** "The AMS fully supports the creation of this new program and we are grateful to the University for including student input in this process." **STUDENT FINANCIAL AID** "The AMS hopes that UBC will be able to commit significant aid and scholarship for this program to ensure these opportunities are accessible to all financial backgrounds."

No individual student submissions were received.

APPENDIX 1: INVITATION TO CONSULTATION AND TUITION RATIONALE DOCUMENT

Good morning,

There is a submission by the Faculty of Science to create the Master of Data Science - Computational Linguistics.

In order to inform the program leads and the Board of Governors with regards to the **tuition proposal** for this program, the University is undertaking a consultative process to get your comments as student representatives, and provide an opportunity for students to provide individual comments on the tuition proposal if they wish. **Please note: the scope of this consultation process is limited to the tuition proposal.**

The consultation will consist of:

1. e-consultation

Please find attached a document which outline the details of the tuition proposal, including:

- an overview of the program,
- the student consultation that has happened to date,
- the tuition rationale for the program, and
- the proposed tuition.

Please share the document and this email as you see appropriate. **Comments on the tuition proposal and student submissions can be provided confidentially to: jenna.omassi@ubc.ca (Jenna Omassi, Advisor, Vice President Students Office).**

2. Face to Face meeting

If requested by student representatives, we can arrange a face-to-face meeting with the program leads regarding this tuition proposal. Please advise as soon as possible if you would like us to arrange a meeting. **THE CONSULTATION PROCESS WILL END ON MAY 14, 2018.**

Confidentiality

Comments will be collected by the Vice-President Students Office, and only staff within that office will know the identity of individual students submitting comments. At no time will anyone outside of the Vice President Students Office know the identity of individual students who submit comments to this consultation. Your comments will only be used for the purposes of the tuition consultation.

Comments from individual students will be stripped of any identifying information to ensure confidentiality, but otherwise will be provided to the responsible program leads and Board of Governors verbatim.

Comments received from student organizations will be reported as coming from those organizations, and provided to the responsible faculty and Board of Governors as received. There will also be a summary report of the consultation developed for the Faculty and Board of Governors.

Please let me know if you have any questions about the process.

Thank you.

Jenna Omassi
Advisor, Strategic Support Team
Vice-President Students' Office
University of British Columbia I Vancouver
jenna.omassi@ubc.ca

NEW PROGRAM TUITION CONSULTATION PROPOSAL

MASTER OF DATA SCIENCE – COMPUTATIONAL LINGUISTICS (M.D.S.–C.L.)

PROGRAM OVERVIEW

As the field of software development continues to grow, software developers and engineers trained specifically in computational linguistics are quickly becoming critical to the success of global businesses, and these businesses are competing to attract employees qualified to address their needs. This trend holds at all levels of industry, including the highest levels: five of the ten most valuable companies in the world today – Alphabet (Google's parent company), Facebook, Amazon.com, Microsoft and Apple – all operate at the intersection between language and computation, whether via search engines, discourse analysis of social media, machine translation or summary. As the field of computational linguistics continues to grow and define the core of the global information economy, the utility of many of the existing tools developed for resource-rich languages like English and Mandarin Chinese are hitting their ceilings, so that new development is increasingly dependent on experts with crossover knowledge between computation and linguistics. In parallel, as the area becomes more and more important in industry, the field of linguistics itself increasingly uses the same computational tools to answer fundamental questions about language as part of basic research.

Responding to these trends, increasing numbers of linguistics students are seeking to develop computational competences, and increasing numbers of software developers already working in the industry are seeking to enhance their existing computational knowledge with skills specifically in computational linguistics. The result is an unfilled need for training programs in this area. The Master of Data Science –Computational Linguistics, which will be the first program of its kind in Canada, is therefore designed to meet three crucial needs:

1. To provide a pathway for the many students with a B.A. to apply their knowledge in a technical domain through training at a top institution;
2. To supply crucial specialized training for developers already working in the industry; and,
3. To bring in new faculty with cutting-edge knowledge; the initiative will offer UBC's faculty access to computational expertise that will complement and support fundamental research in linguistics and many related areas.

Importantly, the MDS–CL builds on the proven track record of the Master of Data Science.

PROGRAM STRENGTHS

The Department of Linguistics is recognized as a top department nationally and internationally, and as part of the Master of Data Science, M.D.S.-C.L. will leverage UBC's established reputation as a centre for linguistics, computer science, statistics, and UBC's growing reputation as a centre for the data sciences.

The proposed program distinguishes itself from existing programs at peer institutions by targeting students who have an undergraduate degree in linguistics or in adjacent language-related fields, such as cognitive sciences or foreign languages, and building on our faculty members' strengths in language documentation and the study of languages that differ (often greatly) from English. This multilingual approach will not be restricted to lectures by department members on their areas of expertise; students will also encounter a broad diversity of languages in the assignments they complete across all classes, enabling them to respond to industry demand for ability to work with less-studied languages.

PROGRAM REQUIREMENTS

Students of the M.D.S.–C.L. will take 24 1-credit courses and a 6-credit capstone project course. The 1-credit courses are organized into four-week courses over 8 months, allowing focused study in particular areas. The 6-credit capstone course is taken in the final 2 months of the 10-month program.

The capstone course enables students to work in groups to simulate the process of solving a domain problem on real-world data. The project work will include posing critical questions about real-world data within a particular domain, making a plan, allocating responsibilities among team members, employing the skills they have learned throughout the program, and reflecting on the strengths and weaknesses of the chosen approach. The students will be mentored by a faculty member during the capstone project.

The 25 courses (24 1-credit courses and one 6-credit capstone course) are:

Fourteen 1-credit courses offered by the Faculty of Science:

Core M.D.S.

- DSCI 551 Descriptive Statistics and Probability for Data Science
- DSCI 511 Programming
- DSCI 512 Algorithms and Data Structures
- DSCI 561 Regression I
- DSCI 552 Statistical Inference and Computation I
- DSCI 571 Supervised Learning I

Fundamental M.D.S.

- DSCI 513 Databases and Data Retrieval
- DSCI 521 Computing Platforms
- DSCI 522 Data Science Workflows
- DSCI 523 Data Wrangling

Advanced M.D.S.

- DSCI 541 Privacy, Ethics and Security
- DSCI 563 Unsupervised Learning
- DSCI 572 Supervised Learning II
- DSCI 575 Advanced Machine Learning

Eight COLX courses specific to the C.L. option and **one six-credit capstone:**

Fundamental C.L. option

- COLX 521 Corpus Linguistics
- COLX535 Parsing for Computational Linguistics

Advanced C.L.

- COLX 525 Computational Morphology
- COLX 531 Machine Translation
- COLX 561 Computational Semantics
- COLX 563 Advanced Computational Semantics
- COLX 565 Sentiment Analysis
- COLX 585 Trends in Computational Linguistics

Electives (each student will take two)

- COLX 523 Advanced Corpus Linguistics
- COLX 527 Advanced Computational Morphology
- COLX 533 Advanced Machine Translation
- COLX 581 NLP for Low-Resource Languages

Six-credit Capstone project

- COLX 595 Capstone Project

Length	Time for completion of the program is 10 months of full-time study (8 months for the 24 one-credit course modules, and 2 months for the capstone project).
Total credits	30
Credits of required programming	twenty-four required 1-credit modules completed during the fall and winter semesters, and a 6-credit capstone project completed during the summer semester, with the modules delivered in two-week blocks

Target students:

Bachelor-level graduates with a background in linguistics and allied language-related disciplines and individuals already working in relevant industry who are interested in gaining a deeper knowledge of computational linguistics to advance their careers.

STUDENT CONSULTATION DURING THE PROGRAM DEVELOPMENT PROCESS

A survey of Linguistics and Cognitive Systems alumni (12% response rate from 340 invitations) revealed:

- 41% have since completed additional courses in the field of computer science
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- A market analysis performed for Brandeis University by the Education Advisory Board in 2014 also found a strong labour market outlook for computational linguists.

The creation of the Master of Data Science, Computational Linguistics Option has occurred with much encouragement from other institutions with existing master's programs in computational linguistics. The sense among institutions that are offering master's programs in computational linguistics is that the number of trained graduates needed is so large that any new degree programs represent not competition, but rather a means to help satisfy the burgeoning demand for graduates. This has inspired not only encouragement, but also active collaboration. For example, Carnegie Mellon University has offered to share both pedagogical software and server space with UBC, and U. Washington has created an email group to help institutions collaborate with each other.

TUITION AND FEES RATIONALE

Proposed program tuition is $31,212 for domestic students and $42,436 for international students, effective 2019 Winter Session, assessed over three instalments. On acceptance into the program, students will be required to pay a $3,000 non-refundable acceptance deposit to be applied towards their first tuition instalment. Tuition and fee details are included in Appendix 1.

The tuition was set based on an analysis of the tuition of programs in the area of Computational Linguistics in the US and Canada relative to the reputation of the institution offering the program.

Benchmarking

Institution	***Tuition $USD***		***Tuition $CAD***	
USA	***Domestic***	***International***	***Domestic***	***International***
Arizona – MS in Human Language Technology	$29,232	$62,244	$38,705	$82,416
Brandeis – MA in Computational Linguistics	$94,600	$94,600	$125,258	$125,258
Buffalo - Master's in Natural Sciences in Computational Linguistics	$16,305	$20,019	$21,589	$26,506
Carnegie Mellon – Master of Language Technology; MS Intelligent Information Systems; Master of Computational Data Science	$43,000	$43,000	$56,935	$56,935
Colorado Boulder – MS in Computational Linguistics, Analytics, Search and Informatics	$27,520	$31,680	$36,438	$41,946
Georgetown – MS in Linguistics (concentration in Computational Linguistics) (Note: tuition assumes only 1 extra semester of thesis research required)	$49,022	$49,022	$64,909	$64,909
Indiana – MA / MS in Computational Linguistics	$10,860	$35,524	$14,379	$47,036
Rochester – MS in Computational Linguistics	$49,216	$49,216	$65,165	$65,165
Syracuse – MS in Computational Linguistics	$51,948	$51,948	$68,783	$68,783
Texas at Austin – MA in Linguistics (concentration in Computational Linguistics)	$16,660	$33,024	$22,059	$43,726
Washington – Master of Computational Linguistics	$34,830	$34,830	$46,117	$46,117

	Tuition (home currency)		*Tuition $CAD*	
International	***Domestic***	***International***	***Domestic***	***International***
Edinburgh - MSc in Speech and Language Processing	£9,500	£23,700	$15,341	$38,272
Erasmus Mundus – International Master's in Natural Language Processing & Human Language Technology	€7,000	€16,000	$9,767	$22,326
Gothenburg - Master's in Language Technology	0 SEK	273,600 SEK	$0	$39,948
Reykjavik - MSc Language Technology	€10,800	€24,200	$15,070	$33,768
Uppsala - MA in Language Technology	0 SEK	240,000 SEK	$0	$35,042

PROPOSED TUITION AND FEES

For the first five years of the program, 5% of the adjusted revenue is set aside for student financial aid; at year six, 4% of the adjusted revenue is set aside for student financial aid.

	Domestic	**International**
Tuition fees per instalment – Note 1	$10,404.00	$14,145.33
Minimum No. of Instalments	3	3
Continuing Fees per Instalment (assessed after 3 instalments)	$745.89	$2,868.22
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Non-Refundable Acceptance Deposit – Note 3	$3,000.00	$3,000.00

Note 1 – Proposed tuition will be subject to annual increases as established by the university. Tuition and student fees are charged in three equal instalments payable in January, May and September.

Note 2 – This is the current fee for the 2019W application cycle and is subject to annual increases.

Note 3 – The non-refundable acceptance deposit will be applied towards the first tuition instalment.

APPENDIX 2: STUDENT SUBMISSIONS

There was a submission from the AMS.

Student Society
of UBC Vancouver

Submission to the UBC Board of Governors regarding the Tuition for the New Master of Data Science, Computational Linguistics
May 14th, 2018

Dear Board of Governors,

This submission is being made on behalf of the Alma Mater Society (AMS) of UBC Vancouver in response to the request for feedback from the Vice President Students Office sent April 12, 2018 on the tuition for the Master of Data Science, Computational Linguistics.

The proposed program tuition is $31,212 for domestic students and $42,436 for international students.

This Masters' degree will be the first of its kind in Canada, spearheading the development of Canadian leaders in the continuously growing field of software development. The program will equip students with knowledge that is swiftly becoming critical to the success of global businesses whom are competing to attract expert employees with crossover knowledge between computation and linguistics.

The AMS appreciates that these opportunities are made available to both domestic and international students with parity to similar Masters' programs around the world. The AMS hopes that UBC will be able to commit significant aid and scholarship for this program to ensure these opportunities are accessible to all financial backgrounds.

The AMS fully supports the creation of this new program and we are grateful to the University for including student input in this process. We look forward to the creation of the New Master of Data Science, Computational Linguistics program and the great work that will be accomplished by those students who enroll in it.

Sincerely,

Marium Hamid
President
AMS Student Society of UBC Vancouver
president@ams.ubc.ca

Max Holmes
Vice President Academic and University Affairs
AMS Student Society of UBC Vancouver
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