Ying Wu College of Computing (YWCC)
New Department of Data Science (DS) Proposal

Presented by Cristian Borcia, YWCC
at the Institute Faculty Meeting

March 31, 2021

Summary: The YWCC strategic plan for 2020-2025 calls for significant growth of the college, with the aim to double student enrollment at all levels by 2025. Data Science (DS) is a major strategic direction that will allow us to reach this goal. We are already offering a very successful MS in DS program and are preparing to launch a BS in DS program in Fall 2021. Furthermore, our faculty have been receiving significant external funding for DS projects from both federal agencies and private companies. With the existing department of Computer Science bursting at its seams, we believe that a new department of Data Science (DS) within YWCC will be a natural evolution to host the BS DS and MS DS programs, as well as the faculty working in DS. This new department will bring national/international visibility to our programs, which is vital to grow their enrollments. This visibility is also expected to help our faculty research in terms of grant funding and national/international collaborations. The rest of this document expands on the need for a department of DS, outlines the expected trajectory of this department, and discusses the impact of its creation on faculty, instructional staff, and students.

1. Data Science Growth Nationally

Data Science is the study and practice of extracting information and structure from data that can then be used for reasoning and adding value to the solution of a problem. It has growing applications in health and medicine, finance, marketing, economics, genomics, neuroscience, transportation, social networks, cybersecurity, journalism, and many other science and engineering fields where data is collected. Data Science relies heavily on the management and analysis of large data setsusing computers running sophisticated algorithms based on mathematical and statisticaltheory. Thus, the underlying technology is mostly drawn from the fields of computing and applied mathematics.

Data Science is critical to national competitiveness. A National Science Foundation report, titled "Realizing the Potential of Data Science," states: "The ability to manipulate data and understand Data Science is becoming increasingly critical to current and future discovery and innovation." Further, McKinsey predicts that data-driven technologies will bring an additional $300 billion of value to the U.S. health care sector alone, and by 2020, 1.5 million more "data-savvy managers" will be needed to capitalize on the potential of data, "big" and otherwise. In the tri-state region and nationally, there is a critical and growing need for a workforce skilled in data science in industry, labs, and government. Glassdoor ranked data scientist as the best

job in America for the past five years and LinkedIn listed data scientists as one of fastest- growing jobs for the past six years. According to Business Insider, data scientist continues to rank as the best jobs in America, with an average compensation of $120,000 per year (Glassdoor).

Research-wise, both federal agencies and private companies are investing a huge amount of money in data science. Therefore, faculty working in this area are in a favorable position to attract significant external funding and to make an impact in real life.

2. Data Science in YWCC

Data Science has been a strategic direction in YWCC for the past 6 years, and this is reflected in our new DS programs, the new research Institute for Data Science, and the hiring of DS faculty. We are running a very successful MS DS program, launched in Fall 2017, (also at NJIT@JerseyCity since Fall 2019 and online since Spring 2021), which currently has over 160 enrolled students. Following this success, we are in the final stages of creating a BS in DS program to start in Fall 2021. The program has been approved at all levels at NJIT, and we are waiting for State approval in early April. Both the MS DS and BS DS programs are offered incollaboration with the department of Mathematical Sciences.

To support these programs and to increase our national/international research visibility in DS, we have been steadily hiring top faculty in this area. For example, in CS, there are faculty working in machine learning, artificial intelligence, data mining, big data, bioinformatics, medical informatics, image processing, and cloud computing. In Informatics, there are faculty working in data visualization, information integration, biomedical text mining, search engines,recommender systems, deep learning for ecological data, social media analysis, and knowledgeengineering.

This hiring effort allowed us to launch the research Institute for Data Science in 2019, which fosters collaborative inter-disciplinary research across all NJIT colleges and schools to conduct both basic and applied research. Distinguished Professor David Bader was hired specifically for this purpose. Using the framework provided by this institute, our faculty have obtained significant external funding for DS projects from both federal agencies and private companies,such as NSF, ONR, DOE, Google, Facebook, Adobe, and Qualcomm, to name just a few.

3. Why a New Department of Data Science (DS)?

We believe the time has come to create a new department of Data Science (DS), which will embody our strategic efforts to further grow DS education and research in a distinct

administrative unit. In simple terms, DS is centered on data, CS is centered on computing, and Informatics is centered on applications of computing. More specifically, DS deals with all data aspects, such as data collection, data storage, data representation, knowledge extraction from data, visualization of insights derived from data, bias and fairness in data and machine learning algorithms, and data privacy.

The DS department will:

- *Bring visibility to DS programs*. The BS in DS and MS in DS programs, as part of the Computer Science (CS) department, are 2 out of 9 programs, which makes it difficult to distinguish and promote them to prospective students. Having a separate department housing these programs is expected to increase their visibility and grow the enrollment in these programs.
- *Be among the first DS departments in the northeastern region of the US.* NJIT can be part of the first national wave of DS departments. Recently, top national universities have started to create such departments or schools. In the northeastern region, there are only Yale and Cornell. Across the nation, there are several more, with distinguished examples being CMU, UT Austin, and University of Virginia.
- *Provide leadership across university for DS research*. Having most faculty that work in DS be part of the same department will increase the opportunity for research collaboration. Furthermore, the new department can reach out to other departments across NJIT to workon inter-disciplinary DS projects and increase the external grant funding.
- *Provide a natural development in the growth of YWCC*. As the numbers of students and faculty in YWCC increase, it becomes difficult to manage very large departments such as computer science. Therefore, creating a new DS department makes sense in terms of having manageable-size units in the college.

4. Department of Data Science: Student and Faculty Growth Projections

In the following, we present projections of the total enrollment in the DS programs, as well as the T/TT faculty and lecturer hiring plan for the new department over 5 years. These projections assume the creation of a new DS PhD program in 2023. Furthermore, they considerthe online enrollment in our MS DS program, with the online version of the program becomingavailable in Spring 2021. The student enrollment projections are based on: (1) the current enrollment and historical trends for the MS DS program; (2) the general trends in computing enrollment in YWCC and the current numbers of applicants and admitted students for the BS DS program; and (3) the conservative assumption of at least 1-2 Ph.D. students per faculty member in the DS department.

	2021-2022	2022-2023	2023-2024	2024-2025	2025-2026
BS Enrollment	20	40	80	135	200
MS Enrollment	200	250	300	350	400
PhD Enrollment			10	20	40
New T/TT Faculty Hires	3	3	3	3	3
New Lecturer Hires	1	1	1	1	1

5. Steps Toward Creation of a New Department

The creation of the new department has followed the guidelines specified by the NJIT Faculty Handbook. The steps so far include: (1) presentation of the idea to create a new DS Department in a college meeting (March 2020); (2) consultations with several YWCC faculty with researchand teaching interests in DS to gauge faculty interest in creating a DS Department (early November 2020); (3) consultations with the Dean of MTSM, the Dean of CSLA, and the Chair of Math Department (end of November 2020); (4) presentation of the proposal to the entire YWCC membership in a college meeting (earlyDecember 2020), (4) sharing the proposal with all faculty members in the CS and Informaticsdepartments (mid-December 2020), (5) sharing the proposal with the Provost for initial feedback (mid-December 2020), (6) presentation and discussion of the proposal at the Dean's Council, where it received unanimous support (early January 2021); (7) initial presentation of the proposal to the Committee on Faculty Rights and Responsibilities (CFRR) and to the Faculty Senate for feedback (mid-January 2021); (8) presentation of the proposal in the Academic Leadership Council (early February 2021); (9) sharing of the proposal with all NJIT faculty outside YWCC for feedback (early February 2021); (10) presentation and discussion of the proposal, following by votes of support in the CS and Informatics departments, where the proposal received strong support (mid-February 2021). The feedback received at every step in the process has been incorporated in this document.

Following consultations within YWCC, six faculty members (of whom four are full professors) from the existing departments (primarily CS) have expressed interest in switching their primary appointments to the new DS department. Once the department is created, we plan to invite YWCC faculty with significant research and teaching interests in DS to formally join the new department. Since we expect at least 4 full professors to join the DS Department, the new departmental P&T committee will satisfy theminimum number of 3 full professors specified by the Faculty Handbook. Two of these professors will be appointed by the Dean as Chair and Associate Chair for the first year of existence of the DS department. During this year, the DS Department in consultation with the Dean will decide whether to hold elections to select an internal Chair or to do an external search for a Chair. With the support of one administrative assistant, these faculty members will act as the core group that will work toward the creation of the new DS department.

We will embark on a sustained hiring process for the next 5 years to ensure the necessary critical mass of faculty for the expected number of students in the DS programs. The specific research areas for the new hires will be determined by the new department in consultation with the Dean. Furthermore, colleagues from other departments at NJIT can request secondary joint appointments which will strengthen our inter-disciplinary DS research collaboration.

6. New Department Impact on YWCC Faculty, Students, and Departments outside YWCC

The main impact of this proposal will be a reduction in the size of the CS department, as a small number of faculty members and the students of the BS in DS and MSin DS will move from the CS department to the DS department. We see this as a *positive* impact, since it will make the CS department more manageable. We do not expect any significant *negative* impact on YWCC faculty, students, and existing departments within YWCC or within other colleges. The proposal was presented to the entire faculty of YWCC ina college meeting and, subsequently, shared with all faculty members. No faculty member declared themselves "impacted" by the proposed department creation. Furthermore, the proposal was pre-sented in CS and Informatics department meetings, in which both faculty and instructional staff participated. The departments discussed and voted on the proposal. As evident in the letters from the two Chairs, there is very strong support for the new department. The letters also express the strong support of the Chairs themselves, who do not envision any negative impact on the two departments.

Any faculty member in YWCC who works in DS will have the opportunity to move to the DS Department, but no faculty will be required to do so. The faculty members who move to the DS department will be encouraged to apply for a secondary joint appointment in their orig-inal departments (CS and Informatics), and it seems natural that it will be granted. In this way, they will be able to continue to advise PhD students in these departments until a PhD in DS will be created (or longer if requested). Therefore, there will be no negative impact offaculty research-wise. In terms of teaching, the DS department will use the same teaching load policy currently in effect in CS. Over time, a number of CS (and perhaps IS) courses that are part of the BS DS and MS DS will change their prefix to DS. This will be done with approval from the current departments offering these courses. Furthermore, the current budgets and TA lines of the existing departments will not be impacted by the new DS Department. Once a new PhD program in Data Science is created in 2023, we expect to receive new TA lines for this program. Until then, the DS faculty will advise or co-advise students in CS and In-formatics. As mentioned earlier, we will encourage them to apply for secondary joint ap-pointments in CS and Informatics, as appropriate. The current instructional staff in YWCC (Lecturers and Senior Lecturers) is expected to stay in their current department. As shown in the hiring projections, we plan to hire instructional staff for the new department, as well.

There will be no negative impact on students. The BS in DS and MS in DS programs will be managed by the new DS department, but the degree programs will not change at all. In addition, since YWCC has a common set of professional advisors for all our students, the BSin DS and MS in DS students will continue to be advised by the same advisors.

There will be no negative impact on other colleges or departments at NJIT. We have already

shared our plans with the leadership and faculty of all other colleges/departments, and they do not have any objections. In fact, they expressed support for this initiative because the new DS department opens new possibilities of collaboration. Specifically, regarding our collaboration with the Math department, we will continue to offer the BS in DS and MS in DS jointly. The only change is that the DS department will replace the CS department in this collaboration.

In the same spirit of collaboration, the new DS department will not object if other departments propose courses or programs related to DS aspects specific to their disciplines.A current example of such a program is the Ph.D. in Business Data Science offered by MTSM.Furthermore, if needed, the DS department would be prepared help other departments with service DS courses. This could be an important service for the entire university if Data Science becomes a GER requirement in the future.

Research-wise, many other departments at NJIT have access to large amounts of data and use DS methods to analyze this data. The new DS department will act as both a leader and synergizer across the university to enhance DS research collaboration. We expect such collaborations to be instrumental in enhancing NJIT's international visibility in DS and to attract more external funding for our DS initiatives.

7. Conclusion

We believe the creation of a new department of Data Science (DS) within YWCC is critically necessary for the strategic growth of the college. Specifically, this department will help increase our enrollment in data science and related programs and will bring national/international visibility to DS research performed at NJIT. Furthermore, the creation of the DS department makes sense in terms of having manageable-size academic units in the college. So far, we receivedpositive feedback from faculty and administrators across NJIT. We already have a core group of faculty members who will work to create this department. We are poised to create the new department as soon as possible.

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Professor and Chair

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February 12, 2021

Craig Gotsman, Dean
Ying Wu College of Computing
NJIT

Re: <u>Proposal for a new Department of Data Science in YWCC</u>

Dear Dean Gotsman:

At the scheduled meeting of the Department of Computer Science on February 10, 2021, Dr. Cristian Borcea described the proposal for a new Department of Data Science within Ying Wu College of Computing. The initial version of the proposal was distributed among the instructional staff (TT faculty + lecturers) on December 13, 2020, and the latest version was distributed 6 days before the meeting, including among the academic advisors of the Ying Wu College of Computing.

Dr. Borcea emphasized that joining the new Department of Data Science will be voluntary. After the presentation the participants (instructional staff + academic advisors) were asked to express their opinions, ask questions, and give any other relevant feedback on the proposal. One feedback was a proposal to establish a "grace period" of about a year in which faculty members would be able to join the new Department of Data Science.

One concern raised in the meeting was the risk that the enrollment in the Department of Data Science will cannibalize the enrollment in the Department of Computer Science. It was noted, however, that only freshmen and sophomores will be able to switch their major to Data Science, minimizing the transfer of current students. Based on the projected enrollment in both departments and the different student populations targeted by both departments, most faculty members agreed that the impact of potential cannibalization will be marginal.

The Department of Computer Science strongly endorsed the proposal. To reinforce this endorsement the department voted on the following motion "The Department of Computer Science supports the creation of the new Department of Data Science". The results of this vote were overwhelmingly positive (22 Yes and 1 No, among Tenured and Tenure Track Faculty).

The initial list of CS faculty members who expressed interest in joining the new department was shared with me by Dr. Borcea, and indeed the main research area of all these is Data Science. They teach mostly Data Science courses that are currently offered in the Department of Computer Science curriculum. These faculty will continue to teach the same courses until the courses are transferred to the new department. CS students will be able to continue and take these courses as both required and elective courses. Naturally, having a department that is focused on Data Science will increase the variety of courses in this area which will increase the number of elective courses available to CS students and provide them the opportunity to supplement their Computer Science expertise.

Based on the current close collaboration between faculty members in the CS department whose research is focused on Data Science and other faculty members, I am confident that the scientific collaboration among faculty members in both departments will be very productive.

In summary, I believe that the proposed new Department of Data Science will have a very positive impact on the Department of Computer Science.

Sincerely,

Baruch Schieber
Professor and Chair

February 12, 2021

Department of Informatics

From: Frank Biocca, Chair

To: Craig Gotsman, Dean YWCC

Subject: Informatics Department Vote of Support for the New Data Science Department

The Informatics Department held a faculty meeting on Feb. 10, during which the creation of a new department of Data Science was presented and discussed. The written proposal for this was circulated prior to the meeting.

Following a discussion, a vote among all instructional staff (TT faculty + lecturers) was taken on whether to support the new department. Of the 27 votes cast, 25 supported and 2 abstained.

There was a discussion of advisement of current Ph.D. students in the Informatics department by a faculty who joins the new DS department. It was clarified that they can maintain a joint appointment in the original department.

There was a question about which department will vote for tenure if a TT faculty decides to join the DS Department. It was indicated that, following standard procedure, the department in which the faculty holds the primary appointment is the tenure home.

Sincerely,

Frank Biocca