“WHEN PEOPLE TALK ABOUT ‘THE NEXT BIG THING,’
THEY’RE NEVER THINKING BIG ENOUGH.”

- DANIEL BURRUS, WIRED MAGAZINE
It is an exciting time. Not only for we at the University of New Hampshire, but for all of humanity. For the first time in our collective history we have moved from a life based in incremental change to one of exponential change. Think about what that means.

Information is flooding our daily lives at a rate faster than we can humanly process it. Our expanding technological capabilities will need to continue help us with much of this processing, but rather than replacing human interaction, our new abilities should allow people to do what we do best: ask more questions.

In this new “age of questions”, people will be challenged to act, think and live differently. The skills we need now, and in the future, will be ever changing as well. No longer can we as learners be complacent. We will need to be lifelong learners and part of an evolving world dialogue. We at UNH and in the Graduate Programs in Analytics and Data Science are excited to be a partner to that conversation.

In 2016, the UNH Graduate Programs in Analytics & Data Science celebrated its first full year as a program. On May 21st of 2016, we graduated our first Masters of Science class. On May 23rd, we welcomed our second cohort, doubling the size of our first.

What you will find in these pages is a snapshot of that first year, starting in May of 2015 and culminating with our new entering class in May of 2016.

By all accounts our interdisciplinary approach and unique highly applied program model have been a success.

Here are some highlights:

- Our graduating students have realized 100% placement earning highly competitive wages, most with multiple job offers upon graduation. (page 4)
- Our student population continues to be among the most diverse on campus. (page 3).
- Our connected faculty continue to grow and teach in thoughtful and comprehensive ways. Page 7 highlights CHHS Professor Prashant Mittal’s spotlight on teaching and on page 10 meet Professor Billur Akdeniz Talay, Associate Professor of Marketing Analytics in the Paul College.
- Our list of program partners continues to grow. This year we partnered with 4 organizations for practicums and had many more visit our classroom. (page 20)
- We are viewed as a leader in the field. (page 15)
- Finally, we continue to develop and launch innovative applied programs that meet the needs of industry and society. On page 19 see a conversation with Professor Alex Booth on the new online certificate in Data Science launching in January of 2017. And on page 17 learn about UNH’s new interdisciplinary DataLab.

We are at the beginning of a new and exciting era in learning, in the types of careers our students will pursue, and in our daily lives. UNH and the Graduate Programs in Analytics and Data Science hope to be a valuable resource in that journey for our students, employers, and society as a whole.

We hope you’ll join us as we continue to Learn. Apply. & Lead!
OUR MISSION:
To train analytic and data science professionals who develop innovative solutions to real world programs and challenges through experiential learning and interdisciplinary teaching by practicing faculty, field experts and industry partners.

VISION:
The Graduate Programs in Analytics and Data Science at UNH are technologically sophisticated and ethical catalysts for change who, through innovative, interdisciplinary programs at all levels, help organizations achieve competitive advantage and work toward the betterment of peoples and societies.

RICH VALUES:

RESPECT: for individuals’ roles, diversity, contributions and viewpoints.

INTEGRITY: to have ethical behavior in our relationships, practices and decisions.

CURIOSITY: as a foundational, lifelong practice for comprehensive learning.

HUMILITY: to learn from others and remain teachable.
<table>
<thead>
<tr>
<th></th>
<th>Class of 2016</th>
<th>Class of 2017</th>
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<tbody>
<tr>
<td><strong>Number of Students</strong></td>
<td>15</td>
<td>29</td>
</tr>
<tr>
<td><strong>U.S. Citizen or Permanent residents</strong></td>
<td>73%</td>
<td>76%</td>
</tr>
<tr>
<td><strong>N.H. Resident</strong></td>
<td>60%</td>
<td>62%</td>
</tr>
<tr>
<td><strong>International Student</strong></td>
<td>27%</td>
<td>24%</td>
</tr>
<tr>
<td><strong>Number of Countries of Origin for International Students</strong></td>
<td>6 (Botswana, Canada, China, Ghana, India, Zambia)</td>
<td>8 (Albania, China, Ecuador, Ethiopia, India, Nigeria, Vietnam)</td>
</tr>
<tr>
<td><strong>Average Years Since Undergrad Degree</strong></td>
<td>5 Years</td>
<td>8 Years</td>
</tr>
<tr>
<td><strong>Percent with Previous Graduate Degree</strong></td>
<td>7%</td>
<td>24%</td>
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<tr>
<td><strong>Average Age</strong></td>
<td>28 Years</td>
<td>31 Years</td>
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<tr>
<td><strong>Range of Age</strong></td>
<td>22-53 Years</td>
<td>22-63 Years</td>
</tr>
<tr>
<td><strong>Percent Female</strong></td>
<td>40%</td>
<td>41%</td>
</tr>
<tr>
<td><strong>Percent Male</strong></td>
<td>60%</td>
<td>59%</td>
</tr>
</tbody>
</table>
PRIOR DEGREES OF STUDY:

- Business & Management: 38.5%
- Engineering: 18%
- Mathematics & Statistics: 14.5%
- Humanities: 12%
- Health & Allied Health: 12%
- Science: 14.5%

POSITION TITLES FOR WHICH STUDENTS INTERVIEWED:

2016 GRADUATES SALARY CHANGE

AVERAGE SALARY BEFORE: $34,071.43
AVERAGE SALARY AFTER: $78,125.00
DIFFERENCE $44,053.57
% INCREASE 56.39%
Justin Greenberg was the recipient of the Thakur Scholarship in Healthcare Analytics. Justin received a BS in Mathematics from UNH in 2012. He then went on to work at Lonza Biologics in Portsmouth, NH as a Data Administrator. Justin now works for Elliot Health Systems in Manchester, NH as a Data Analyst.

Justin is also an accomplished bassist who often plays around the seacoast area. It may be Justin’s blending of the quantitative and the creative that made him stand out in our first semester of work. He exemplified all the qualities that a competent and superior student should.

Justin and his practicum team worked on a project for Martin’s Point Health Care. Martin’s Point offers primary and specialty provider offices and services throughout New England, New York and in parts of Pennsylvania. Martin’s Point is also an insurer. Justin and his team utilized clustering analysis to better give Martin’s Point a better sense of the factors that drive their care utilization by patient type. They also developed a predictive algorithm to optimize where MP should place new care centers and provided the project hosts with an integrated and customizable dash board to allow for more specialized analysis.

Justin is known for his many talents including course work excellence and willingness to help other students. We are very proud to have Justin as one of our M.S. Analytics graduates.

“The experience here is invaluable; there is an immense opportunity to grow not only as an analyst, and a human being.”

~Justin, Class 2016
Data Analyst, Elliot Hospital
“CURiosity IS THE ENGINE OF ACHIEVEMENT”

- SIR KEN ROBINSON
What is your teaching philosophy and how do you approach it?

My teaching philosophy is twofold: If I can’t explain it simply then I haven’t understood it well enough, and a good teacher is a great learner. A key ingredient behind becoming a great learner is to diversify interests and learning goals.

I am a slow but avid reader; I may not read for long periods of time in one sitting, but I read every day. I diversify reading with nine or ten books at a time, which is why it takes a very long time to finish a book. Such reading habits helps me recall the storyline when I pick up a book after a break and always keeps reading interesting. I also read magazines like Time, National Geographic and Nature regularly. I don’t intentionally read to find links between data science and the topic of the reading, however, when those links are relevant, they build on their own at a subconscious level. Such phenomenon, in return, helps me recall varying ideas and examples while explaining a deeper concept during lectures or discussions. I call it the learning isomorphism.

I learnt an important lesson very early in my teaching career that manifests in the classroom: teaching is similar to the performing arts. If I am not satisfied with my performance, then audiences who are students, may not enjoy and thus not learn from it either. Even after eighteen years of continuous teaching, it takes me on average three hours of preparation for every one hour of delivering a lecture that consists of a mix of theoretical and practical components in a case study based environment. My teaching is also shaped by the values that we at the Analytics institute emphasize upon: Respect, Integrity, Curiosity and Humility. While all four are important, the last two are crucial for modern learners. One must stay curious in order to learn and one must stay humble in order to stay curious.

How is this program different in its approach to teaching students and what outcomes are you witnessing? What do you think the key factors are to student learning?

I believe that we should teach the way we would have liked to be taught. Emotions are the key to learning and there are various ways of evoking emotions during class lectures. Having learnt from what worked for me as a student and through various trial and errors as a teacher, I implement a few practices.

Students learn best when:

a) Lectures are accompanied by hands-on cases and examples. The purpose of cases is to replicate theory. The most effective cases are those that are of disruptive nature, especially the ones that have a potential of bringing about a social, business or personal change.
b) Part of their student assessment is defending homework assignments in the form of an interview. Students are interviewed in groups of four or five where they discuss the nuances of data science in groups and then individually answer questions specific to the assignment. They are also asked to assess themselves.

c) I run a series of presentations called “Teach the teacher”. Students are given topics to research on their own and make a cogent case in a formal presentation. I believe there is nothing more satisfying than being able to teach effectively a new concept to your teacher and fellow students.

d) I emphasize on the importance of failure. Students have better learning outcomes when they are not afraid of failing. The key to successfully implementing a new product, a new model or a project is to work on the most important pieces, that also have the biggest chance of failing. I encourage students to try to work on those pieces first by attempting to fail the task at hand. This counter intuitive approach works quite effectively.

e) Our program is nimble in nature. Not only is the curriculum a moving target based on the needs of the industry and academia, but also what works inside the classroom. We believe that no two group of students are similar and thus no two classrooms should be taught the same exact way. We gather student feedback on a regular basis and make appropriate changes in a timely fashion. For instance, we devote Friday’s for improving soft skills such as communication and management skills. We learnt that students did not enjoy the “podcast series” which entailed making a short presentation on a data science related podcast that was assigned to them. We immediately discarded the activity and replaced it with an entrepreneurship and innovation series which challenged students to design a futuristic product, create an all-encompassing business plan and convince fellow students on the importance of that product. This change and activity was well appreciated.

f) I talk to them and not talk at them. A simple habit of calling everyone by their names have a large impact on the learning experience, especially for those who are of introvert nature.
The Graduate Programs in Analytics and Data Science utilize an innovative hub and spoke curriculum with a modular format. Students take courses in traditional semesters: summer, fall and spring. Each semester is defined by four courses, listed in the below map. Each course, however, is further divided into sub-modules that vary in length of instruction. The summer semester represents the introductory period of the program, the fall an intermediate level and the spring more advanced and application driven instruction modules. Students in each course may be taught by a variety of instructors through its duration. Students in the fall and spring conduct a practicum on real industry data, and on which methods are applied. In addition, students also then take a two course specialization cluster on a field topic of their choosing.
How are analytics impacting the field of marketing?

Marketing analytics consists of tools, technologies, and processes that help marketers to evaluate the overall effectiveness of their marketing strategy and programs using important key metrics, performance indicators, and attribution rates. Overall, it enables businesses to make more successful decisions in addressing customer needs, and hence, improve performance.

In late 1990’s, marketers have been put more under pressure to prove the relationship between marketing initiatives and company’s financial performance. Since then with the rise of the availability of data and technologies companies have adopted a more data-centric and analytical approach to prove this relationship for a more successful marketing. When you discuss big data and analytics, one of the most important data sources in business environments is consumers. Now with the advancements in digital marketing, social networks, and emergence of new platforms, the types and amount of consumer data that companies have access to are exploding. The meaning and format of data itself even changed from being structured to more unstructured. In this environment, analytics help companies to visualize current; and predict and propose future strategic and tactical directions in a more systematic fashion. It helps marketers create a competitive edge, understand and predict their customers better, and develop new products and services that are more prone to succeed.

How does the UNH Analytics program help students stand out when they are looking for a job or a career change?

When we look at professional networking sites such as LinkedIn, we see that one of the top three skills in the pool of hottest skills that get people hired by companies in recent years is consistently data mining and analysis. In this environment, UNH Analytics prepares its graduates to succeed in the rising fields of data science and analytics by providing a curriculum that aims to surpass the industry demand. I think that the biggest strengths of the program are the practicum project, the interdisciplinary nature, and the emphasis on experiential learning that help our students stand out in the job market. By offering an in-depth training in quantitative applications, computational methods, and
critical thinking through a one-year on-campus program to students with diverse backgrounds it is becoming a competitive program in fulfilling the rising demand for workforce in the analytics field across various industries.

WHERE DO YOU SEE MARKETING ANALYTICS GOING IN THE FUTURE?
A recent study by Adobe titled Digital Distress finds that 76 percent of marketers think marketing has changed more in the past few years than the past 50. I think the change will be constant in the forthcoming years. The variety of data and revolutions in technology and data science fields continuously change how marketers understand, predict, enhance, and thus creates a high impact customer experience. In relation to this continuous change, in the future, a data-driven marketing organization is going to mean not only being good at obtaining, analyzing, and driving inferences from data but also being dedicated to transform your marketing in terms of its culture, structure, people, and role within the whole company. This transformation should bring marketing more to the core of many other business functions in the organization.

QUOTES FROM OUR 2016 GRADUATES

“Initially, I was simply looking to update my data toolbox with SQL and SAS to supplement my primary research career and increase job opportunities. I not only achieved this goal but also learned about other data mining tools like Python, Hadoop, Tableau, as well as proper applications of these tools for data cleaning, data management, predictive modeling, web scraping, and visualization. I can’t thank UNH enough for preparing me so completely as I enter this exciting field of analytics.” ~ Carol

“I feel that my prospects to land a great job and one I will enjoy, are greatly increasing, especially so with the decision science part of the program. Honestly, I couldn’t have picked a better program!” ~ Derrick

“I really valued the relationships I built with professors and industry partners.” ~ Kevin

“I had reached a saturation level with respect to my salary and role; this MS in Analytics degree has opened up a new set of opportunities.” ~ Priti

“The Analytics program was probably the most fulfilling academic experience I have ever had and was directly applicable to the job market. It was the perfect mix of being challenging, fun and interesting.” ~ Pat
UNUM INSURANCE
Kofi Ebakyea, Alex Booth, Alissa Andrews
The specific goal is to predict the duration of short term disability claims upon intake in order to optimize claim assignment and to resolve claim cost. The team also investigated the introduction of new technologies and methodologies to the traditional analytic approach previously used that held the potential to decrease the analytics Q&A and deployment timeframe by a substantial amount.

MARTIN’S POINT
Justin Greenberg, Jon Vignaly, Priti Joseph
This project proposed to derive a method for identifying associations between mental disorders and physical comorbidities using patient segmentation models based on patient demographics, metrics for resource utilization, and historical claims data. An interactive geospatial dashboard was further developed to optimize the location of a new care centers.
OPIOID PRESCRIBING IN NH
Adrienne Martinez, Carol Page
This project examined the medical nature of the opioid epidemic in New Hampshire using the NH Comprehensive Health Care Information System (CHIS) to look at county based rates and trends in prescribing ( opiates, treatment & blockers), mortality by drug use, diagnoses and SUDS (substance abuse disorder) within the state. Outcomes provided county-based analysis of prescribing and opioid use as well as treatment. In addition, the outcomes exposed the value and limitations of public use data in performing this type of inquiry and suggested policy change and further research for improved future analysis.

MAPPING STUDENT SUCCESS AT UNH
Team 1: Derek Naminda, Yuyu Zhou, Alyssa Cowan
Team 2: Rachel Cardarelli, Kevin Stevens, Chris Duleavy
The UNH project defined factors related to student success at UNH. There are three primary objectives of this project: 1) To create segments of various kinds of undergraduate students; 2) to quantify predictors of success amongst those segments; and 3) to quantify psychographic predictors of success. Data included academic histories of students for five years, the first destination student survey, and primarily derived psychometric survey data conducted on UNH students.
"GREAT WISDOM, NOT APPLIED TO ACTION AND BEHAVIOR, IS MEANINGLESS DATA."

- PETER DRUCKER
A CONVERSATION WITH JON VIGNALY, MSA ‘16
ASSOCIATE BUSINESS DATA ANALYST AT DARLING CONSULTING GROUP

“I applied to the UNH Analytics and Data Science Master’s program because I had gotten a small amount of exposure to analytics during some of my undergraduate classes at UNH and I was very intrigued by it. I then started doing work in the analytics field and was teaching myself along the way. I then realized that I needed to learn more than basic analytical techniques and learning how to code to understand and create advanced analytics and the data science predictions I was striving for.

Thus far, I have gotten great value from my Master of Analytics and Data Science degree. In my job, every day I use the skills and programming languages (Python, SQL, Tableau) I learned at UNH to solve problems at my company, Darling Consulting Group (DCG), and provide them with practical and efficient solutions. The cluster courses I took at UNH supplemented the program well and helped in my transition into my new job as well as helping my team to work more efficiently together.

I also continue to stay connected with UNH Analytics, and through DCG I am currently working with this year’s students on a practicum project. The connections, with other students, faculty and industry professionals, that I made during my time at UNH and those that I continue making through UNH since I have graduated are great resources for me in this industry. I have been able to reach out to them with any needs to get feedback on ideas or input on problems. It has been a great community of people available to support me.”

WHY IS UNH’S ANALYTICS AND DATA SCIENCE PROGRAM VALUABLE?

“Problem solving has always been a desirable skill across industries. UNH’s Analytics program provides students with the skills to find the truth in our modern sea of information.”

~ Dan Couture
Senior Data Integration Engineer, Fitbit
WHO WE ARE: PROGRAM FACULTY & STAFF

PROGRAM TEAM & FACULTY

Robert McGrath
Director & Associate Professor

Prashant Mittal
Clinical Assistant Professor

Lyin Schramm
Program Coordinator

Alex Booth
Program Coordinator & Faculty

Mallory Hubbard
Administrative Assistant

INTERDISCIPLINARY TEACHING FACULTY 2015-2016

Tevfik Aktekin
Associate Professor, Decision Sciences

Adam Boucher
Senior Lecturer, Applied Mathematics

Marc Flore
Health Data Analyst, Institute for Health Policy & Practice

Mark Lyon
Associate Professor, Mathematics & Statistics

Arvind Narayan
Lecturer, Computer Science

Ben Porter
Lecturer, Decision Sciences

Phil Ramsey
Lecturer, Mathematics & Statistics

M. Billur Akdeniz Talay
Associate Professor of Marketing

Scott Valcourt
Lecturer, Computer Science

BACHELOR’S OF SCIENCE IN ANALYTICS

DIRECTOR & PROGRAM AFFILIATE:

Jeremiah Johnson
Assistant Professor of Data Science
UNH Manchester
2016-17 has already been an exciting year at UNH Analytics. Here is a look at some of the highlights from the current year and a glimpse of what lay ahead.

**ONLINE GRADUATE CERTIFICATE IN DATA SCIENCE**
Launching in January of 2017, we are pleased to offer this new and flexible learning solution. We will also be exploring corporate training options using this certificate in combination with on-site teaching. See page 19 for more information.

**DATA LAB**
Our programs are pleased to announce the launch of the UNH Data Lab in early 2017! The Data Lab will be a collaborative and interdisciplinary workspace for students from all across the University. Students will work on applied projects, participate in analytics and data science challenges, and hear from leaders in the field on the newest techniques and opportunities.

Data Lab will occupy its own student-centric space at 9 Madbury Road in Durham. Stay tuned for more!

**UNH PARTNERS WITH IBM WATSON ANALYTICS**
In early 2017, UNH will be providing open and free access to IBM’s Watson Analytics platform for all students on all campuses. Partnering with IBM WA will considerably enhance the analytic options students now have to explore our data rich world and promote new insights!

**DUAL MSA / MPP DEGREE**
The Masters in Analytics Program and the Masters in Public Policy Program are collaborating to provide students a streamlined way to receive exciting and highly impactful dual degrees. By utilizing shared courses and capstone work, students can receive both degrees in roughly the time it would traditionally take to finish a two-year master’s degree. This dual degree will be valuable for those wanting to engage in highly data-driven policy analysis, data-informed public administration, or the science of politics.
CHALLENGES & ACCOLADES:
This year’s class has already participated in at least one large data challenge and are going for more! Three of our Masters in Analytics students placed second in the IBM Watson / Data Watch election data Hackathon. Congratulations to them. Three more students plan to compete in the UNH Social Ventures Challenge, and yet three others are participating in the New York City Department of Education Data Analytics Challenge project. Good luck to them all!

SMART CAMPUS, SMART COMMUNITIES & DATA LITERACY RESEARCH
A collaborative faculty group comprised of Analytics and Data Science, the Center for Connectivity Research and Electrical Engineering won a $75,000 grant through the Broadband Center of Excellence to explore the creation of a Connected Campus. The team is piloting the idea with a parking optimization project. The same group with additions from the Sustainability Institute and the Institute for Earth Ocean’s and Space are submitting a Smart and Connected Communities Grant proposal to NSF in late 2016.

The Graduate Programs in Analytics and Data Science were also pleased to be named a project partner to the NSF Big Data Spokes Data Literacy Project being coordinated out of the North East Big Data Hub and the New York Science Hall.

CURRENT SOCIAL MEDIA OUTREACH:

<table>
<thead>
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<th>Platform</th>
<th>Followers</th>
<th>Likes</th>
<th>People Like</th>
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<td>534</td>
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<td>Facebook</td>
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<td>LinkedIn</td>
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Class of 2017
UNH’S NEW ONLINE GRADUATE CERTIFICATE IN DATA SCIENCE
AN OVERVIEW WITH PROFESSOR ALEX BOOTH

Beginning in 2017, we will be launching a new, intensive 16-week asynchronous online graduate certificate that will accelerate entry into the field of data science. Students will build the most in-demand, sought-after skills in industry.

THE CERTIFICATE IS COMPRISED OF FOUR CLASSES:
• In Programming for Data Science, students will gain mastery of Python, using it to wrangle and explore data while learning industry standard tools like version control and UNIX
• In Introduction to Applied Analytic Statistics, students will learn inferential statistics and how to apply this to real world datasets using Python
• In Data Architecture, students will master the fundamentals of SQL & NoSQL databases as well as gain practice in distributed computing
• In Data Mining & Predictive Modeling, students will round out their skill set by creating predictive models using the latest algorithms available, setting up an industry standard validation procedure and learn how to turn this into reproducible data products

FOR WHOM IS IT INTENDED?
We expect students that are working professionals looking for a career change, undergraduate students fresh from graduation as well as anyone in between.

HOW IS IT DIFFERENT?
Data science is fundamentally open, interdisciplinary and diverse. Our online certificate builds these principals into it core and commits to being fully responsive to a rapidly changing field.

We are not repackaging old courses under a new name; we are developing new courses to reflect what industry demands now and going forward. During training, student’s learning will be rigorously cross-validated through assignments and real-world projects to ensure that their skills can generalize to new developments in the field. Students will leave with a valuable set of skills and demonstrable portfolio of work.
ACADEMIC ADVISORY BOARD

Andrew Houtenville
Arvind Narayan
Barry Hennessey
Ben Porter
Billur Akdeniz
Christopher Frerking
Ernst Linder
Heather Turner
Jeremiah Johnson
Jo Porter
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Tevfik Aktekin
Michael Palace
Patricia B. Condon

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TJX
Truven Health
UNH Innovation
UNH Hockey
UNUM
U.S. Dept. of the Navy
Vyasa Analytics
Wildcat Sports Properties
Winning Algorithms
“IF WE COULD ANTICIPATE DISRUPTION WE COULD...”

- QUESTION POSED TO CLASS