FAU
BOARD OF TRUSTEES
Florida Atlantic University

Item: VI.

Tuesday, September 17, 2019

SUBJECT: APPROVAL OF FLORIDA ATLANTIC UNIVERSITY'S FISCAL YEAR 2020-2021 UNIVERSITIES OF DISTINCTION LEGISLATIVE BUDGET REQUEST

PROPOSED BOARD ACTION

Approval of the FAU 2020-21 Universities of Distinction Legislative Budget Request.

BACKGROUND INFORMATION

Each year, in anticipation of the upcoming state legislative session, State University System (SUS) institutions are required to submit their operational legislative budget requests (LBR) to the Board of Governors (BOG) for review. At its August 28-29, 2019 board meeting, the BOG released a new framework that they will now utilize to evaluate individual university LBRs and submit their systemwide legislative request to the Governor and Legislature for consideration. This year, the BOG will seek legislative funding in three distinct categories – Performance Based Funding, Preeminent Universities, and a new category entitled Universities of Distinction. Under this new framework, non-preeminent institutions such as FAU may submit one operational funding proposal that identifies an existing core program capable of reaching national or state excellence. Proposals should demonstrate a unique focus for the institution and must identify appropriate metrics and goals to measure progress and success. FAU has identified artificial intelligence and data-related sciences as its focus and is developing the required metrics and goals.

The BOG also implemented a new requirement that an institution's Board of Trustees approve the LBR that is submitted to the BOG. Because of the accelerated 2020 legislative schedule (the 2020 Legislative Session begins January 14, 2020 and ends Friday, March 13, 2020), the deadline for submitting our 2020-21 Universities of Distinction LBR proposal to the BOG is September 19, 2019.

IMPLEMENTATION PLAN/DATE

Upon approval by the BOT, staff will transmit the LBR to the BOG for consideration at the BOG's October 3, 2019 Committee Meetings.

FISCAL IMPLICATIONS

N/A

Supporting Documentation: FAU 2020-21 Universities of Distinction Legislative Budget Request

Presented by: Mr. Jeff Atwater, CFO and VP for Strategic Initiatives **Phone:** 561-297-3134

State University System
Education and General
2020-2021 Legislative Budget Request
Form I

University(s):	**Florida Atlantic University**
Issue Title:	Universities of Distinction **Applied A.I. & Big Data Analytics ("AI/Data") - FAU100 Year 2**
Date Issue Approved by University Board of Trustees:	**September 17, 2019** (pending)
Recurring Funds Requested:	**$18.1M**
Non-Recurring Funds Requested:	**$0**
Total Funds Requested:	**$18.1M**
Please check the issue type below:	
Shared Services/System-Wide Issue for Fiscal Year 2020-2021	☐
Unique Issue for Fiscal Year 2020-2021	☒

I. Description – *1. Describe the service or program to be provided and how this issue aligns with the goals and objectives of the strategic priorities and the 2019 University Accountability Plan established by your institution. If expanded, what has been accomplished with the current service/program?* 2. *Describe any projected impact on academic programs, student enrollments, and student services.*

Applied A.I. & Big Data Analytics – The Road to FAU100

In a historic first for Florida Atlantic University (FAU), *US News and World Report* included the school in its 2020 list of Best Colleges. FAU was ranked at #281 (tie) for *National Universities* and #140 (tie) for *Best Public Schools*.

To launch the university even closer towards the Top 100 of the list of public universities, FAU will build its national reputation as a **University of Distinction** by A) developing new degrees which underpin growth in the state economy, B) achieving distinction in specific areas of applied research that support the state and national economies, and C) engaging industry to promote strategic economic development throughout the State of Florida.

In line with the SUS 2025 strategic plan and annual accountability plans, the university will use its growing platform of Applied Artificial Intelligence and Big Data Analytics ("AI/Data") to support the ambitious goals laid out in FAU's *Strategic Plan for the Race to Excellence, 2015-2025*.

Background on FAU100

The FAU100 initiative is still the goal. Building on initial success in the 2019 Legislative session, FAU seeks $18.1M to continue to accelerate its journey towards becoming a Top 100 ranked public university according to *US News.*

Importantly, the first-ever inclusion in the *US News* list is an extraordinary achievement for a university that is passionately accelerating its levels of academic recognition on a national basis. FAU views itself as a new national model for a research university. Already nationally recognized for its campus ethnic diversity and many of its academic programs, the university is producing record rates of student success, expanding its research enterprise, and delivering on its promise of access to high-quality higher education.

Building on FAU's *Strategic Plan for the Race to Excellence, 2015-2025*

Since embarking on its strategic plan in 2015, FAU has seen rapid success by building on the strength of specified institutional **"pillars"** (e.g. neuroscience) and **"platforms"** (e.g. big data analytics). Over the past four years, the university launched research institutes to support the pillars. Additionally, FAU has established a path for emerging laboratories and research programs to become centers and institutes once they meet appropriate benchmarks.

As described in the university's 2019 accountability plan that was submitted to the Board of Governors, the university plans to continue to leverage the inherent strengths of its diverse, vibrant student body and its unique geographic location to build a national brand for excellent academic offerings and research programming. Item #3 on FAU's "statement of strategy" section in the accountability plan clearly identifies FAU's commitment to investing in pillars and platforms. Already, the university has seen sustained progress in terms of student success and research, setting the stage for this request.

In 2015, with a new president and new strategic plan in place, FAU launched a remarkable turnaround story. Transformational leadership and enhanced accountability systems led the university to launch analytics teams to intervene when necessary and deliver personalized support to students.

Specifically, in the past five years, the university has succeeded by:

- increasing the four-year graduation rate by 14.6%
- increasing the retention of freshmen with a GPA above 2.0 by 14.5%
- doubling research expenditures to an estimated $70M (FY19)
- developing community partnerships and fundraising at record levels
- earning national recognition for undergraduate research programs
- winning Conference USA titles in baseball, softball, and football
- consistently ranking nationally as a top producer of minority degrees
- becoming federally-designated as a Hispanic Serving Institution
- eliminating achievement gaps for graduation and retention rates for underrepresented minority, first-generation, and Pell students

Entering the Top 100 is an important milestone in FAU's *Strategic Plan for the Race to Excellence, 2015-2025.* Beyond the *US News* ranking, our next steps will be to leverage investments and to pursue the ambitious vision of joining 1) the nation's top tier Carnegie R1 research universities and 2) the state's growing list of preeminent universities.

This is ultimately a long-term plan. AI/Data serves as a clear topical arena that will launch FAU on this path. National recognition comes through notability in a targeted topic. Peers throughout the region, the state, and the country might already be somewhat familiar with the State of Florida's first NSF-funded AI and Deep Learning (AIDL) laboratory – or the Rubin and Cindy Gruber Sandbox, which houses the Machine Perception and Cognitive Robotics Lab. FAU's AI/Data projects received national media attention, and this will continue to accelerate. By shining a light on the numerous successes in this academic area, and by strategically growing enrollments (both undergraduate and graduate), research programs, and corporate partnerships, FAU will build a brand for AI/Data and hit the respective metric benchmarks for *US News,* Carnegie, and preeminence.

By growing AI/Data at the state's most diverse public university (per *US News* and *Chronicle for Higher Education*), FAU will contribute to a diversified, emerging workforce. Throughout the nation, many public research universities struggle to maintain a commitment to access for diverse populations. This is an important differentiating feature and strategic advantage for FAU as a University of Distinction. The student body demographics closely mirror the racial and ethnic backgrounds of the State of Florida as a whole.

Already, FAU has accomplished so much without significant new investments from the state, aside from funds earned through its enhanced and continual improvement in the state's performance-based funding model. After enacting many years of efficiencies, FAU has redesigned itself as a resilient, lean organization—achieving at high rates. Significant investments would catalyze more improvements, as outlined in this request for Distinction in AI/Data.

As illustrated through the university's SUS alignment of strategic goals document, FAU is following the direction of the state Board of Governors. Importantly, this proposal attends to all three major goals: A) teaching & learning; B) scholarship, research, & innovation; and C) community & business engagement. Please note that the following subsections explicitly align with these components of the 2025 SUS strategic plan.

To support these strategic goals, the university seeks resources to accelerate its improvement in **Applied Artificial Intelligence and Big Data Analytics** to earn recognition as a University of Distinction and as a Top 100 public school.

A) Continuing to introduce novel degree programs

In terms of educational programming, FAU has already launched a number of innovative degrees, concentrations, and certificates that fall under the AI/Data category and contribute to its case as a University of Distinction:

- In June 2019, FAU's Board of Trustees (BOT) approved a new **master's in artificial intelligence**, which is offered by the College of Engineering and Computer Science and launched Fall 2019 as the first program of its kind in the State of Florida.
- In June 2019, FAU's Board of Trustees (BOT) approved a new **master's in data science and analytics**, which is offered jointly by five different academic colleges and launched Fall 2019 with 4 concentrations including data science & engineering; data science *via* scientific inquiry; data analytics in business; and data science in society.
- In Fall 2019, the Harriet L. Wilkes Honors College and the College of Engineering and Computer Science jointly launched two **BA/BS → MS graduate pathway programs with data analytics tracks** in computer science and information technology management (also in conjunction with the College of Business).
- The Harriet L. Wilkes Honors College launched both a **major concentration in data analytics** and a minor concentration in data science, which focuses on disciplinary knowledge and the emerging field of the ethics of data use.
- The College of Engineering and Computer Science offers **a Ph.D. in computer science with a concentration in data analytics**.
- The Charles E. Schmidt College of Science and the College of Engineering and Computer Science offer a **joint undergraduate certificate in data science**.
- The College of Business and the College of Engineering and Computer Science offer **a joint graduate certificate in big data analytics**.

Given the tremendous opportunities for growth, FAU is also currently in the planning phase to launch **a new bachelor's degree in data science on the Jupiter campus**, which will be interdisciplinary in nature across all eight undergraduate colleges, per a retreat held in October 2018. The hope is that these students will benefit from exposure to the Max Planck Florida Institute for Neuroscience and Scripps Florida, both of which have world-renowned research programs in the area of cognition and learning processes.

FAU is already preparing graduates to lead in the 4th industrial revolution, which will focus on AI/Data and Autonomy. Funds from this proposal will enhance the university's ability to recruit high-ability students, as well as to continue to launch novel degree programs in the area of AI/Data.

Locally, startups and established companies have difficulties to recruit AI/Data professionals due to the scarcity of qualified professionals. Nationally, not just the economic side but also the security side, the US needs to invest heavily in AI/Data to be competitive. Other countries spend billions of dollars in AI research and education. Increased employer demand for master's-level AI professionals indicates an opportunity for the program development. Data collected by EAB Global indicates that the state-wide demand for such professionals increased 423 percent from 86 to 450 postings (EAB Market Research Brief, 2018). Reported high earnings in relevant occupations will attract prospective students to the program.

AI-related professionals earn a median income of **$46/hour state-wide**, which is substantially higher than the state's average median income of $16/hour.

South Florida is home to many startups and large companies with demands of developing smart devices and products. Recently, a number of local companies such as Magic Leap, Cendyn, and Florida Power and Light (FPL) came to FAU to seek AI/Data professionals, which led to the curricular developments outlined above.

Given the demand, degree programs in AI /Data will produce professionals who serve the region, state, and nation. FAU will need to continue to increase the number of graduates of these programs to contribute to meet the needs of these employers. Additionally, more students will support the research enterprise by serving as graduate research assistants. This will all have a positive impact to the local/regional/state economy, as described in detail within the ROI section at the end of this proposal.

As presented in the report by McKinsey Global Institute on "Big Data: The Next Frontier for Innovation, Competition, and Productivity," the United States faces a growing shortage of 140,000 to 190,000 workers with analytical expertise and shortage of 1.5 million managers and analysts with the skills to understand and make decisions based on the analysis of big data. In 2015 4.4ZB data were generated and only less than 10% was analyzed in time. Furthermore, the data will be doubled every two years.

Of note, on a national basis, less than 10% of students in the field closely related to AI/Data are black, and similarly for woman and Hispanic population. Currently, the university's highest-enrolled racial/ethnic demographic is Hispanic students (27%), followed by black students (21%). By encouraging minority and women students to pursue undergraduate and graduate studies in AI/Data, FAU will produce more technology professionals who are minority and women.

Projections from Hanover Research (2017) illustrate the increasing and broad demand for AI/Data professionals on national, state, and local levels:

National Occupational Projections, 2014 to 2024

SOC Title	Employment		Change 2014-2024		Avg. Annual Openings
	2014	2024	Number	Percent	
Computer and Information Systems Managers	343,330	419,080	75,750	22.1%	11,730
Computer and Information Research Scientists	23,120	27,240	4,120	17.8%	730
Computer Programmers	320,410	323,910	3,500	1.1%	9,280
Software Developers, Applications	726,010	931,180	205,170	28.3%	31,030
Software Developers, Systems Software	398,640	484,630	85,990	21.6%	14,270
Computer Occupations, All Other	226,850	249,660	22,810	10.1%	5,280
Mathematicians	1,760	2,130	370	21.0%	50
Operations Research Analysts	90,040	122,440	32,400	36.0%	4,900
Statisticians	31,050	42,280	11,230	36.2%	1,730
Mathematical Science Occupations, All Other	1,040	1,160	120	11.5%	300
Cartographers and Photogrammetrists	11,670	15,660	3,990	34.2%	770
Total – All Data Science Occupations	**2,173,920**	**2,619,370**	**445,450**	**20.5%**	**79,800**

Source: Bureau of Labor Statistics[48]

Florida Occupational Projections, 2014 to 2024*

SOC Title	Employment		Change 2014-2024		Avg. Annual Openings
	2014	2024	Number	Percent	
Computer and Information Systems Managers	10,560	13,210	2,650	25.1%	390
Computer and Information Research Scientists	510	570	60	11.8%	10
Computer Programmers	12,550	12,580	30	0.2%	310
Software Developers, Applications	30,710	40,090	9,380	30.5%	1,380
Software Developers, Systems Software	13,290	16,470	3,180	23.9%	510
Computer Occupations, All Other	7,750	9,220	1,470	19.0%	250
Mathematicians	120	150	30	25.0%	10
Operations Research Analysts	6,270	8,450	2,180	34.8%	330
Statisticians	820	1,310	490	59.8%	60
Cartographers and Photogrammetrists	540	830	290	53.7%	50
Total – All Data Science Occupations	**83,120**	**102,880**	**19,760**	**23.8%**	**3,300**

Source: Projections Central

*Some occupations are not listed due to lack of available data at the state level.

Palm Beach County Occupational Projections, 2016 to 2024*

SOC Title	Employment		Change 2016-2024		Avg. Annual Openings
	2016	2024	Number	Percent	
Computer and Information Systems Managers	970	1,172	202	20.8%	36
Computer Programmers	1,054	1,029	-25	-2.4%	26
Software Developers, Applications	3,010	3,542	532	17.7%	108
Software Developers, Systems Software	802	934	132	16.5%	28
Computer Occupations, All Other	360	415	55	15.3%	11
Operations Research Analysts	288	373	85	29.5%	16
Statisticians	22	32	10	45.5%	2
Total – All Data Science Occupations	**6,506**	**7,497**	**991**	**15.2%**	**227**

Source: Florida Department of Economic Opportunity

*Some occupations are not listed due to lack of available data at the county level.

When focusing in on the unique workforce demand for someone specifically trained at the master's level in the area of AI, as opposed to the broader data analytics academic preparation as depicted in the above tables, the specific professional opportunities are clearly growing in both the region and state.

EAB Global Research (2018) produced the following table using the Emsi Labor Market Analytics tool specifically in regards to the master's in AI:

Earnings and Growth Projections in Top Regional and Statewide Occupations for Master's-Level Artificial Intelligence Professionals

Regional and Statewide Data

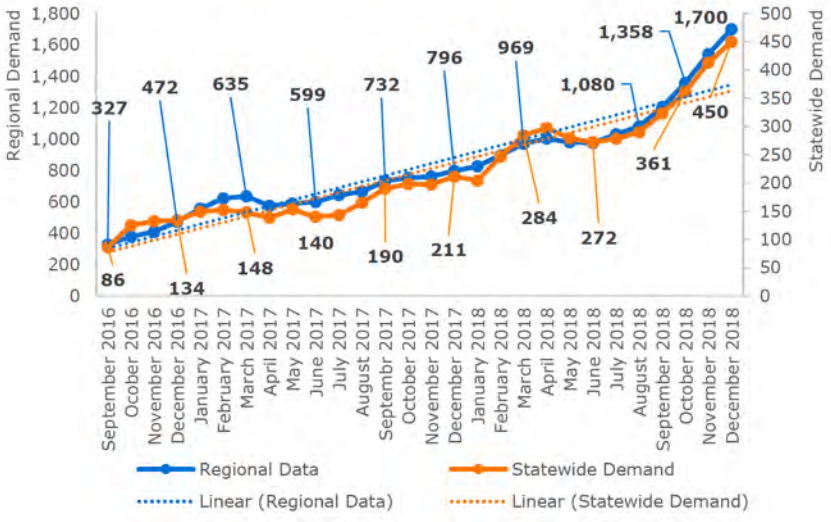
Occupation	Sample Job Titles	Regional Median Hourly Earnings	Employment Growth 2016-2026
Computer and Information Research Scientists	Computer Scientist, Control System Computer Scientist, Computational Theory Scientist	$51.25 (regional) $46.05 (state	+ 28.8% (regional) + 44.8% (state)
Software Developers, Applications	Application Integration Engineer, Applications Developer, Database Developer	$44.65 (regional) $42.32 (state)	+42.5% (regional) +45.1% (state)
Computer Occupations, All Other	Solutions Architect, Data Architect, Computer Laboratory Technician	$39.18 (regional) $36.36 (state)	+ 28.9% (regional) + 34.7% (state)
Management Analysts	Research Analysts, Analytics Consultants, Business Consultants	$34.96 (regional) $31.29 (state)	+ 22.7% (regional) + 23.4% (state)
Market Research Analysts and Marketing Specialists	Data Scientists, Senior Scientists, Business Analysts	$27.76 (regional) $27.89 (state)	+ 36.5% (regional) + 35.9% (state)

When displayed in a linear format, this information showcases the timeliness of the AI/Data proposal as it relates to educational programming, especially for those students who are enrolled in the university's new master's in AI.

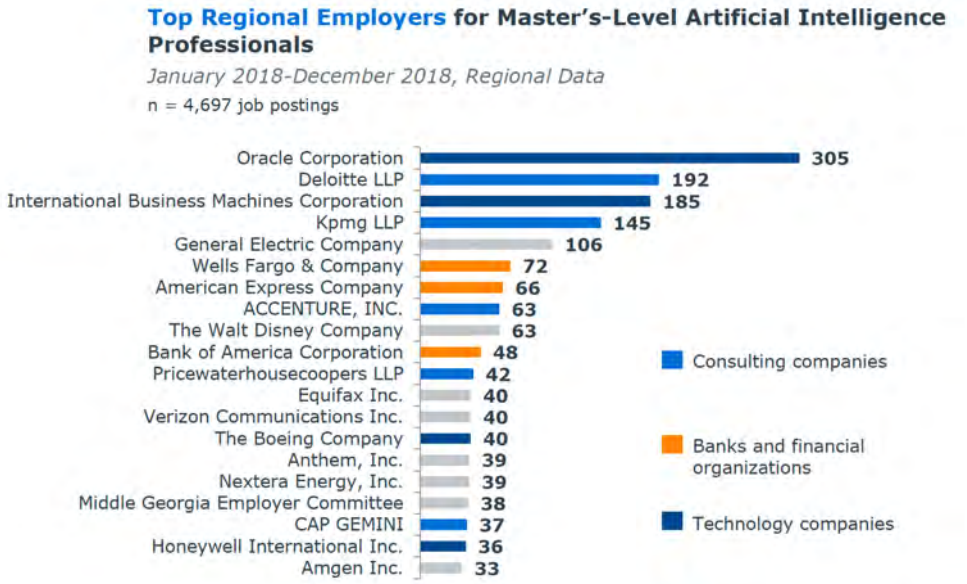
Linear trend lines represent the average monthly change in statewide and regional employer demand for master's-level artificial intelligence professionals.

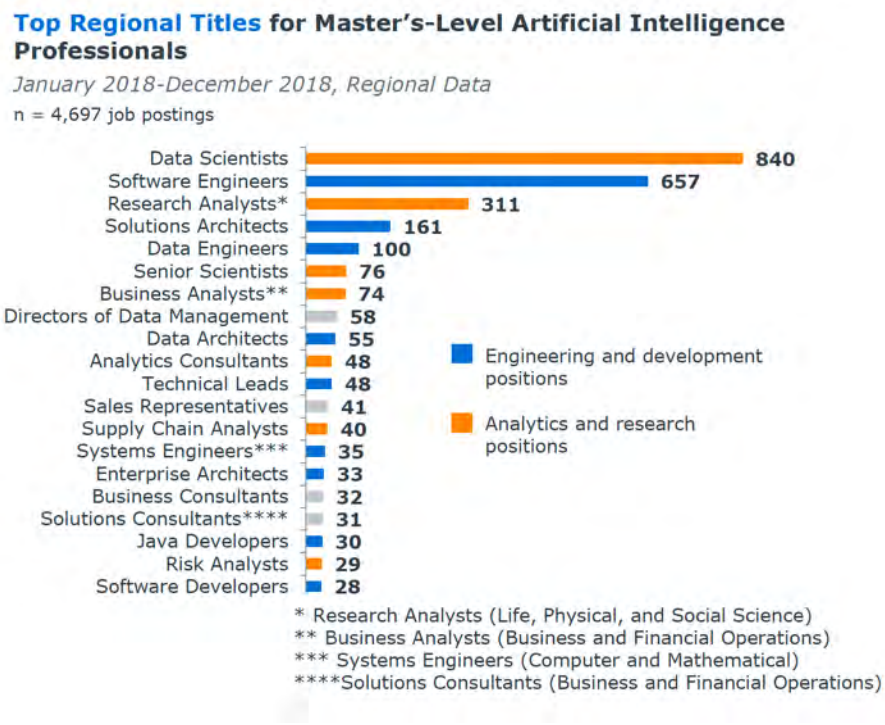
Historical Employer Demand for Master's-Level Artificial Intelligence Professionals

September 2016-October 2018, Statewide and Regional Data



Per the same EAB Global Research (2018) report, the following regional employers are the ones hiring AI professionals into these positions:





This proposal responds to the growing demand in the labor market. With preexisting degree programs, and positioned between large cities such as West Palm Beach and Fort Lauderdale, FAU is uniquely prepared to produce a state workforce that will contribute to the rapidly-growing AI/Data field.

B) Achieving distinction in specific areas of research

In addition to a growing portfolio of related academic programs as outlined in the section above, research activity in AI/Data is currently thriving at FAU. The university is similarly poised to receive national recognition as a University of Distinction for its AI/Data – and is growing the number of student researchers who can support the ongoing work in labs and centers.

Currently, FAU boasts $26M in active grants in the area of AI/Data, which includes some projects that were initially funded nearly a decade ago and the continuously funded through today, as well as more recent new awards.

As a formally-designated *2025 FAU Strategic Plan* platform, "Big Data Analytics" has succeeded in its ability to support all four of the institutional pillars (and associated research institutes). Under each of the pillars below is just some of many examples of active AI/Data research projects/laboratories.

1. **Healthy aging - Institute for Human Health and Disease Intervention (I-HEALTH),** Executive Director Dr. Gregg Fields
    - $7M grant to faculty in the Christine E. Lynn College of Nursing, focusing on health data analytics and big dataset curation related to older adults and extended care facilities
    - Additional projects related to the use of data in electronic medical records, the use of AI tools to stop social media abuse, encryption of biometric data and secure computations, nuances of compliant storage protocols and solutions, cloud-based medical diagnostics, bioinformatics/human genomics, fraud detection in healthcare, and advancement of autonomous robotics and regenerative nerve systems
2. **Neuroscience - Brain Institute,** Executive Director Dr. Randy Blakely
    - $1M gift from Rubin and Cindy Gruber a 3,400-square-foot the Ruben and Cindy Gruber Sandbox resource center to enable students to directly engage with the fast-advancing field of artificial intelligence
    - Additional projects related to data mining, machine/deep learning, natural language processing, automating electron microscopy, and neural segmentation
3. **Ocean science/engineering and environment science - Harbor Branch Oceanographic Institute (HBOI),** Executive Director Dr. Jim Sullivan
    - $1.25M grant from the United States Office of Naval Research to support autonomous unmanned marine vehicle platforms
    - Additional projects related to the impact of automation on land use, integration with robotics and bio-robotics (e.g. the novel soft robot jellyfish), as well as the monitoring of marine structures

4. **Sensing and smart systems - Institute for Sensing and Embedded Network Systems Engineering (I-SENSE),** Executive Director Dr. Jason Hallstrom

    - $652,820 grant from the National Science Foundation (NSF) to establish the State of Florida's first NSF-funded Major Research Instrumentation (MRI) Artificial Intelligence and Deep Learning (AIDL) Training and Research Laboratory
    - Additional projects related to media technology (i.e. how virtual reality interfaces improve learning and empathy), spatial computing and eye tracking for autonomous cars, the role of AI in transportation, spatial network data processes, and data-driven evacuation planning in emergency management

While these pillars have been mentioned in FAU's annual accountability plan for the Board of Governors (each year since 2015), the platform of big data analytics has also played a growing role at the university. By definition, platforms are cross-institutional support mechanisms. Each one of these pillars houses a number of experts who conduct research in AI/Data.

The capacity of the university's AI/Data researchers to support the pillars occurs through big data analytics, data mining, data sorting, and data processing. All of these mechanisms are possible due to advances in the areas of sensing and computing systems. Without such developments, AI (in which machines have the capability to make assumptions, test, learn, and decide autonomously) and machine learning (in which data trains machines to learn environments and actively engage in intelligent processes) could not exist.

To showcase the university's expertise in AI/Data with broader audiences, FAU will host a Data Science and Analytics Conference in November 2019, as well as the 18th IEEE International Conference on Machine Learning and Applications in December 19. In Spring 2020, the university plans to host a conference on Connected Vehicles in Smart Cities: The Future of Transportation and Logistics as well as a National Conference on Emerging Technologies in Multimedia.

Additionally, the future for federal spending in the area of AI is bright. The importance of AI as a national priority was memorialized in Executive Order No. 13,859, 84 Fed. Reg. 3967 (February 14, 2019). Federal agency leaders have already been instructed to prioritize their budgets with significant investments in AI, as well as plan for increased collaborations with research universities and industry in order to operationalize these efforts.

The evidence that this proposal will attract research funding exists in FAU's broader track record of increasing total research expenditures over the course of the last five years. The number of funded awards is up from 231 in FY15 to 423 in FY19. In FY15, the university's research expenditures were $29.6M. The latest estimate for FY19 (only four years later) is $70M. Proposals are also

trending positively, reflecting the comprehensive faculty buy-in to increase research productivity along strategic themes. In line with its strategic plan, FAU more than doubled research expenditures and will continue to increase.

Federal funding agencies such as NSF, NIH, DARPA and ONR have provided numerous opportunities in AI/Data and its related areas. These funding opportunities have helped the US capitalize on the full potential of AI/Data to strengthen our economy, better our society, and improve our national security (NSF, 2018). With specialized programs in AI/Data, the university will attract likeminded faculty and students who are passionate about big data, automation, and their applications. It is anticipated that more competitive proposals will be written by the AI/Data faculty with the help of the undergraduate and graduate student research efforts.

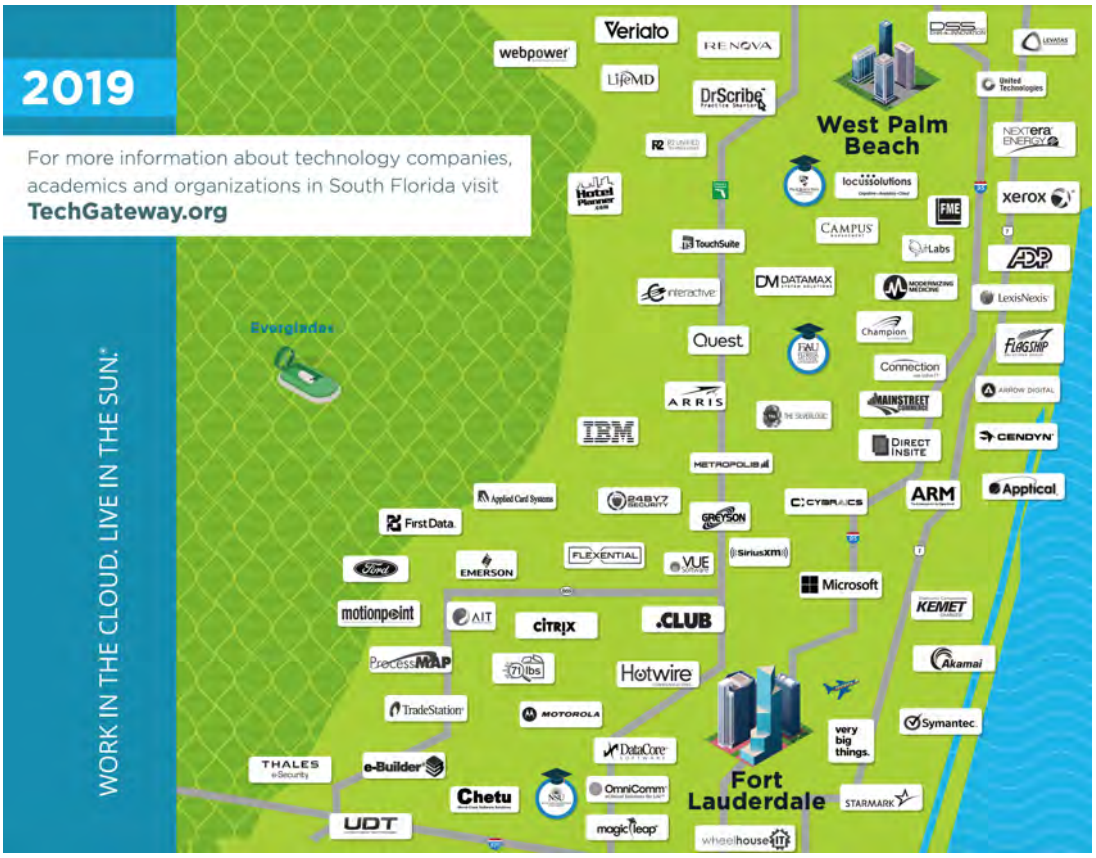
C) Engaging industry to promote economic development

FAU is geographically well-positioned to become a University of Distinction in AI/Data. According to the South Florida TechGateway (a partnership between Palm Beach County's Business Development Board, the Greater Fort Lauderdale Alliance, and the Miami-Dade Beacon Council), the region is home to "nearly 80,000 information and communication technology workers" with an average wage of more than $100,000. Additionally, these three counties rank #1 in the United States for startup activity.

Notably, the first IBM PC was created in Boca Raton, which is home to FAU's largest campus. More than 1,400 technology companies are located in Palm Beach County alone (Business Development Board, 2019). With global reach and three international airports all within driving distance of multiple technology-based national and international corporate headquarters, South Florida is the third most-populous state but home to the fourth-most number of technology companies (BDB, 2019). FAU would like to change this by serving as the nucleus for the AI/Data industry.

One of the university's foremost strengths is in applied research across all of the disciplines. For example, the Council on Undergraduate Research in 2017 ranked FAU as the #1 doctoral-level university in the nation for its robust undergraduate research offerings. Students in any academic field have the opportunity to participate in hands-on projects to better understand basic concepts and to gain valuable experience prior to joining the workforce.

The vision that FAU has for AI/Data is one of intimate collaboration with the large, powerful corporations that neighbor the university. Ideally, the university will leverage its undergraduate and graduate researchers as problem solvers for partners in industry. In other words, a company that encounters an intractable AI/Data problem will articulate the issue to FAU – and the university will pair the company with the appropriate group of students and faculty members to provide a solution. This is a national model for higher education, and FAU already possesses the infrastructure to help.



Additionally, the university would seek to partner with industry in order to pilot AI/Data solutions in a test environment. Universities have access to a diverse array of end users who would be suitable for such opportunities. These types of reciprocal relationships are the basis for FAU's efforts in community engagement, as defined by the Carnegie Foundation for the Advancement of Teaching. The university submitted its application for "community engaged" classification to Carnegie in Spring 2019 so that it can formally recognize the mutually beneficial partnerships that it shares with its surrounding community. AI/Data serves as an important institutional platform on which FAU can continue to build its community engagement.

The diversity of corporate fields is likewise growing, and FAU is actively involved with preparing highly-skilled workforce that will eventually do jobs related to AI/Data that do not yet exist. With more than 6 million residents, the metropolitan region of South Florida is home to corporations that will have a variety of AI/Data applications, including healthcare, transit/logistics, communications, security/defense, agriculture, tourism/hospitality, manufacturing, and the financial industry, among others. Thanks to enhanced technological capacity through AI/Data, these companies will need to rethink their entire approach to human resource management and planning. Each of these industries will have the opportunity to engage their respective disciplines – throughout all of FAU's ten colleges – for support in discovering solutions to business processes and other AI/Data applications.

FAU's emerging specialization regarding AI/Data is focused on applied research. As noted previously, data analytics is a growing area of focus not just for traditional AI/Data disciplines like science, technology, and engineering – but also for social inquiry (e.g. FAU uses AI tools to stop social media abuse), business (e.g. FAU has immense analytical capacity to study marketing, finance, real estate, sport management, and medical records), and arts and humanities (e.g. FAU uses augmented reality to reconstruct historical sites and to integrate with entertainment technology). Together, the university's interdisciplinary track record, paired with its collaborative, applied research portfolio, makes it ripe to become a University of Distinction in AI/Data.

Proposal for FAU's Applied A.I./Big Data Analytics Platform

The university has outlined the following spending plan for its AI/Data proposal, which will further fuel efforts to be a University of Distinction and a Top 100 public school. These strategic expenditures directly align with the first two goals from FAU's *Strategic Plan for the Race to Excellence, 2015-2025.*

Proposed expenditures

Boldness - a uniquely competitive and globalized student body (**recurring)**

$2.8M	Employment-based student incentives
$1.2M	Success networks for undergraduate students
$4.4M	Enhanced instruction *via* graduate students

Synergy - prominent teams of researchers and scholars (**recurring)**

$1.0M	Institute for Sensing and Embedded Network Systems Engineering (I-SENSE)
$2.0M	Harbor Branch Oceanographic Institute (HBOI)
$1.4M	Institute for Artificial Intelligence, Autonomy, and Data Analytics (ArIADA)
$12.8M	**Recurring request**

Synergy - prominent teams of researchers and scholars (**nonrecurring)**

$3.0M	Jupiter High Performance Computing (HPC) - AI/Data processing
$0.5M	Fort Lauderdale Media Technology and Entertainment (MTE) Lab for AI integration with virtual/augmented/extended reality
$1.8M	AI Robotics Testbed - Ocean/sea-surface/ground/air
$5.3M	**Nonrecurring request**

$18.1M	**Total request**

The spending plan for this legislative budget request is rooted in national best practices, as well as proven institutional practices. The benefits of such allocations are intended to, in a targeted manner, enhance the experience of FAU's students (both undergraduate and graduate), its research enterprise, and industry relationships as it becomes University of Distinction for AI/Data.

The request for this year builds off last year's FAU100 request, which was ultimately funded by the Legislature at $12M (before the university absorbed its portion of the system-wide cut). Last year's request aimed to rapidly work towards the university's strategic goal of broadly ascending to the Top 100 of the *US News* public rankings. In contrast, this request responds to the Board of Governors' desire to focus the efforts of institutions on specific areas of distinction – but to leverage the national recognition earned through the advancement of AI/Data programs in order to become ranked in the Top 100.

Expenditures will generally fall under the following categories:

$2.8M Employment-based student incentives

In order to both recruit and retain the highest-achieving students, FAU will leverage offers to students to participate in on-campus employment and other financial support programs. As described in the sections above, the university has a preexisting undergraduate research and inquiry framework (ranked #1 in the nation in 2017 by Council for Undergraduate Research) that can engage industry through problem-solving activity. Notably, students who receive offers for employment in on-campus positions are more engaged and more likely to succeed in their collegiate careers. This makes sense, as these students are spending more time with the campus community focusing on their disciplines of choice rather than working in unrelated part-time jobs.

Additionally, employment offers come in the form of stipends or bi-weekly checks, which can indirectly fund their cost of attendance but not necessarily reduce their eligibility for financial aid in the same way that a scholarship would. FAU believes that this program would serve as an effective recruitment and retention mechanism, providing these students with the opportunity to spend more time on campus, earn a wage, and build a portfolio of experience solving problems for industry.

$1.2M Success networks for undergraduate students

As the university strategically grows its AI/Data enrollments, it will not lose sight of the importance of student success. National reputation, both in terms of specific programs of distinction and more broadly in terms of the institution as a whole, rely having globally-competitive students who will succeed in these rigorous programs. Accordingly, the university will continue to develop a variety of student success initiatives that promote retention and four-year graduation rates. Already, it has established a comprehensive system of analytics and student success support teams who are working daily to monitor student progression and promote timely graduation. At FAU, a "Success

Network" is established for each student, consisting of academic advisors, financial aid coaches, and career counselors, in addition to faculty instructors, librarians, and others. This network specifically identifies, in a novel technological platform, the individual members of their own network.

This proposal would allow the university to make strategic investments in order to enhance and grow Success Networks and other student support services. For instance, the university's award-winning academic coaching program will need to enhance its ability to engage students. At the same time, the brand-new Science Learning Center in the Schmidt Family Complex for Academic and Athletic Excellence, which is currently under construction, will need to continue to boost services, especially if more AI/Data students enroll and seek out support. New funds would enhance these strategic operations.

$4.4M Enhanced instruction *via* graduate students

In order to continue to build a uniquely bold student body that thrives, especially in areas of AI/Data, FAU will need to enhance its undergraduate instruction. In introductory-level college coursework, this often comes through graduate teaching assistants. At FAU, the vast majority of graduate instructors come from master's-level programs. The university will convert these students into doctoral students, which comes with multiple benefits, including growth of doctoral programs and a longer time period for graduate instructors to refine their teaching skills (i.e. 4-5 years rather than just 2).

To attract the finest graduate instructors, FAU will offer competitive stipends. This will also directly support the growth of AI/Data graduate programs throughout all colleges, given the wide breadth of disciplines that already offer AI/Data coursework and programs.

$1M Institute for Sensing and Embedded Network Systems Engineering (I-SENSE)

One of four pillars established in *FAU's 2025 Strategic Plan*, I-SENSE was envisioned as a clearinghouse for sensing, communication, data management, data analytics, and security expertise. It was designed to operate as an interdisciplinary hub, catalyzing research initiatives that crosscut disciplines, academia, government, and industry. The institute's mission is to catalyze a culture of research excellence in sensing and smart systems; to develop, demonstrate, and operate technological solutions with high societal impact; and to attract and support future generations of researchers and practitioners.

The team currently includes two full-time administrative staff, three full-time engineering staff, nine Faculty Fellows, approximately 40 affiliated faculty, approximately 30 graduate students, three postdoctoral researchers, and approximately 15 undergraduate researchers. On average, I-SENSE Faculty Fellows secure, as Principal Investigator, $2.15 for every $1 invested. Affiliated I-SENSE faculty, excluding I-SENSE Faculty Fellows, were responsible for approximately one-third of all new awards in 2019 ($24M). The team's work is

broadly supported through active investments from the NSF, NIH, NIST, DOD, state, municipal, and industry partners.

The proposed plan will support emerging opportunities in optogenetics, bio-photonics, tissue diagnostics, and potentially, next-generation networking architectures. Importantly, healthcare-related areas benefit significantly from computer vision expertise.

Attracting outstanding postdocs and graduate students remains an important opportunity to accelerate growth. Fellowship programs are a powerful financial mechanism to attract top-tier talent. The budget includes support to establish a postdoctoral fellowship program and a graduate fellowship program, at levels comparable to analogous federal awards. In each case, use of the internal fellowship funds to attract an external candidate will require a one-to-one match with external, non-state funds. The model retains the institute's emphasis on external support, while enabling I-SENSE researchers to attract the best postdocs and graduate students in the country.

The proposal includes funding for part-time student employees, and the budget also includes $350K in materials and supplies for start-up laboratory purchases, $15K for graduate student tuition, and $10K for domestic travel

Additionally, this request includes the following personnel:

1. Faculty hire ($217.6K salary + fringe)
2. Staff engineer ($61.2K salary + fringe)
3. Two postdoctoral researchers ($71.4K salary + fringe / each)
4. Two graduate fellows ($30.6K salary + fringe / each)
5. Two undergraduate student workers ($17K salary + fringe / each)

$2M Harbor Branch Oceanographic Institute (HBOI)

As the University's northernmost campus, HBOI's recent research innovations include creating novel autonomous sensing systems, designing next generation ocean-observing tools, developing new shellfish and fish species for sustainable aquaculture and food security, searching the deep ocean for cures for disease, and monitoring fragile Florida ecosystems like the Indian River Lagoon. As one of the four research pillars of FAU, HBOI is building upon the strengths that lie within the institute and the university and embarking on a new quest to expand innovation and success through collaborative research and education.

Florida's coasts and waterways are a critical environmental and economic resource for the state. Unfortunately, Florida finds itself on the front lines of many significant and recurrent problems related to climate change, land use practices and pollution in these environments. FAU proposes to develop the next generation of "in-water" coastal observatory nodes similar to the Land-Ocean Biogeochemical Observatory (LOBO) network HBOI currently supports

(http://fau.loboviz.com), but one that is more amenable to expansion and inclusion of new technologies and sensors and with improved data visualization and automated interpretation through artificial intelligence. Development of this transformational technology will provide comprehensive, coordinated and integrated monitoring systems for Florida's estuaries and coastal waters.

The next generation of sensor systems and data loggers will integrate with real-time communications and visualization software. HBOI intends to populate Florida waterways with technology to incorporate novel sensors (e.g. in-situ holographic microscopes, in-situ toxin assays, acoustics, etc.) into the nodes for much improved coastal monitoring and assessment.

When made functional, the coastal network could improve Florida's monitoring of harmful algal blooms (detection and early warning), climate change effects (sea level rise, acidification, coastal hypoxia, etc.), coral reef health, fisheries, eutrophication (nutrient pollution) effects, etc. With this investment, Florida could become a national and international leader is developing the technology and vision for responsible management and control of these problems that have world-wide relevance.

The budget request includes new HBOI faculty hires, post-doctoral and graduate student researchers and engineering technicians as well materials and supplies for system and sensor development. In terms of expenses, the university proposes $375K for permanent sensor installation, $400K for materials and supplies, $400K for faculty research startup funding, $15K for domestic travel, and $30K for graduate student tuition.

Additionally, this request includes the following personnel:

6. Two faculty hires ($217.6K salary + fringe / each)
7. Staff engineer ($91.8K salary + fringe)
8. Two postdoctoral researchers ($71.4K salary + fringe / each)
9. Two graduate fellows ($30.6K salary + fringe / each)

$1.4M Institute for Artificial Intelligence, Autonomy, and Data Analytics (ArIADA)

Establishing a brand-new Institute to support AI / Data will serve to synergize research and curricular development among the faculty and students on all campuses at FAU. Already, the strategic plan platform of Big Data Analytics is a focal point for collaborative research and AI/Data curricular enhancements in all forms. The university will be empowered to expand data curation and data mining techniques and processes across all colleges. Through these activities, the institute will enable FAU to become the leader in AI/Data research, applications, and training in South Florida.

Instead of siloed, discipline-specific advancement of elements in the AI ecosystem, the proposed institute is applied-solution-centered that will create AI/Data products in thematic areas of distinguished research expertise and track-record at FAU. The solutions will incorporate all necessary elements in the AI-ecosystem stack as defined by NSF -- from data acquisition, massive data analytics and management, machine and deep learning, modeling, AI infrastructure – all the way to autonomy and human-machine interaction. FAU will serve as a regional resource, providing access to AI/Data infrastructure and also conducting training for industry and even social service agencies.

Through this funded proposal, the show of support from the State of Florida (and recognition for establishing a new institute for AI/Data) will further enhance the level of research funding coming from federal and private agencies. Additionally, the State's support will multiply the impact of the already-strong engagement with local and national industry. The focus on applied AI will open the doors of the university to companies that are seeking FAU's research know-how (e.g. FPL, GE) or recruiting the university's well-trained graduates (e.g. Belcan, FPL).

To build capacity, the university proposes to invest $120K in computing hardware and $200K in cloud computing capacity.

Additionally, this request includes the following personnel:

1. Director ($250,000 salary + fringe)
2. Associate Director ($150,000 salary + fringe)
3. Administrative support ($75,000 salary + fringe)
4. Two professor-level hires ($150,000 salary + fringe / each)
5. Four postdoctoral researchers ($300,000 salary + fringe / total)

$3.0M **Jupiter High Performance Computing (HPC) - AI/Data processing** (nonrecurring)

As a follow-up to the announcement in January 2019 of the NSF MRI-funded AI training and research laboratory, FAU seeks to expand its existing high-performance computing (HPC) center in Jupiter. If funded, this project would result in FAU becoming the number one AI-supporting organization in the State of Florida – and possibly the entire Southeastern United States.

FAU seeks $3M for core computing nodes and supporting hardware, which would reside in the existing HPC data center in Jupiter. Upgrades would enable the university to equip two existing computer labs with AI/Data infrastructure to provide students and researchers with direct access to the technology. Additionally, versions of lab units would also be available for use by off-campus industry. Essentially, the upgrades will allow AI/Data users to directly run jobs on the HPC cluster from one of the two labs – or even their own office if they are equipped with compatible high-quality user interfaces.

Some examples of "shovel-ready" HPC applications across disciplines:

- **Developing personalized (precision) medical systems**, including analyzing patterns in genomics data; machine/deep learning for computer-aided diagnosis/screening; high resolution image reconstruction; predictive modeling for healthcare; clinical decision support systems; and AI-powered drug discovery. Health information is doubling every 76 days. The challenge is how to make meaningful use of high-volume data to create a healthcare model that is more personalized, predictive, and proactive, and that can be delivered at lower cost. Currently, FAU's top NIH-funded genomics medical researcher, Dr. Janet Robishaw, relies on Geisinger Health System and University of Pennsylvania to provide machine learning infrastructure expertise that does not exist at the university (or elsewhere in the state). With the initial investment in infrastructure above, FAU could establish itself as a clearinghouse for Florida's community hospital system.
- **Integrating with the Nikon Center of Excellence at FAU's Brain Institute,** further supporting collaborations in instrumentation design and implementation, as well as providing training courses on basic and advanced microscopy techniques. HPC upgrades could further fuel developments in the visualization of the complex structures and functions of nervous systems in 3D, in multicolor, and with the motion of real life.
- **Hands-on training in deep learning at the Rubin and Cindy Gruber Sandbox in FAU's Wimberly Library,** which would be available to students across a broad range of levels and disciplines (both from within and outside FAU) and would culminate in a certificate in deep learning, one of the first of its kind in the world granted by a research university. The HPC upgrades will also enable students and researchers to run AI jobs at the Sandbox, which will be equipped with advanced visualization stations, robotics, rovers, and project kits. Additionally, the Sandbox is developing a data-warehouse of pre-processed data-sets and models that are ready-to-use in classes and for future research projects. FAU will provide these to faculty throughout the various colleges, as well as to other state institutions.
- **Benefiting methods/analytics courses across disciplines,** allowing students to run HPC jobs in fields like real estate and health administration. Upgrades will benefit spatial analyses in criminology and urban planning.
- **Supporting the recently-launched Max Planck Academy (MPA) at FAU in Jupiter,** which was launched in 2018 in conjunction with the world-renowned Max Planck Society of Germany (FAU is their only dual enrollment high school partner in the world). At the MPA, high school students will have the opportunity to conduct advanced applied research with some of the world's most successful AI/Data scientists. Already, FAU has piloted the MPA with FAU High School students who studied analytics alongside researchers from the Max Planck Institute. The pilot was so successful that FAU is now pressing forward with expansion with Jupiter High School, which will launch Fall 2020 and benefit from HPC upgrades.

$0.5M **Fort Lauderdale Media Technology and Entertainment (MTE) Lab for AI integration with virtual/ augmented/extended reality** (nonrecurring)

The School of Communication and Multimedia Studies at FAU is uniquely positioned to offer a state-of-the-art, comprehensive, and interdisciplinary approach to AI/Data. Researchers will use cutting-edge technology to work on AI to move and expand the current Media Technology and Entertainment lab to Fort Lauderdale. Projects will include the use of extended reality (XR) technologies to improve learning and empathy (AI in particular will open the doors to new user experiences). Additionally, researchers specialize in the production of games, animation, interactive media (G.A.I.M), which would produce a synergy with the highly-populated downtown Fort Lauderdale by attracting students and making connections with local industry leaders.

Funding would enable researchers in the lab to craft stations where students can have observable/reflective experiences with AI (not just make it – but engage it). AI/Data technology ultimately interacts with humans, so a trans-disciplinary lab would include not just the infrastructure for creating such technology, but also space for evaluating its use from a variety of different lenses. This approach can also lead to more developments for empathic and socially-engaged technology.

Much of the research on the impacts of AI/Data is taking place in silos, with practitioners, engineers, and developers isolated from rhetoricians, ethicists, and scholars of media, communication, and technology. Because the School of Communication and Multimedia Studies (SCMS) encompasses both cutting edge media production and extensive scholarly research at the intersection of communication, technology, and social change, the School is poised to become a leader in the study and practice of artificial intelligence technologies. This is an opportunity to capitalize upon SCMS's strengths to ensure that developments in AI/Data not only address, but also avoid, the current problems that plague this emerging field. This unique lab will contribute to the AI/Data initiative not only through its technological implementation in virtual reality (VR), augmented reality (AR) and spatial computing, but also in the level of oversight—socio-political, philosophical, and aesthetic—researchers can provide in unravelling the implications of nascent AI/Data technology.

$1.8M **AI Robotics System Testbed - Ocean/sea-surface/ground/air** (nonrecurring)

FAU proposes the university's first shared testbed for research and education in AI, machine learning and multi-domain connected robotics. These resources will help develop state-of-the-art technology, connecting robotic systems across domains such as ocean, sea-surface, ground and air. Interdisciplinary researchers will work together to develop and validate testbed solutions for applications related to AI-driven coastal monitoring and resilience, AI-assisted emergency management, cybersecurity, AI-enabled 5G devices, as well as Internet of Things smart environments.

The system output would involve "autonomy in-a-box." When the "box" is attached to a programmable device (computer, robotic system, drone, vehicle, etc.), it converts/upgrades the programmable device to an autonomous system. Box-enabled individual robotic systems can then self-form networks of connected robotic systems. When a high-level mission/task is issued to one or more of the box-connected robotic systems, then AI technology will enable execution and performance of the mission/task by autonomous members of the robotic network.

Costs for this project include $300K advanced wireless networking platforms and cloud computing. Additionally, the university will expend $1.5M to develop a network for ocean/sea-surface/ground/aerial robotics, humanoids, bio-inspired soft robots, as well as motion capture space and a drone cage for safe testing.

Succeeding in Education, Research, and Community Engagement

By bridging all the disciplines in its *FAU 2025 Strategic Plan* platform of big data analytics, FAU has already launched novel degree programs, expanded its research enterprise, and promoted economic development. AI/Data is where the federal government is heading, and it's where the local and state industry partners are already working with FAU to enhance the South Florida region's AI/Data capacity. With appropriate resources, the university is prepared to do much more. Beyond the more immediate benefits of delivering higher volumes and quality of student and faculty technical experts in AI/Data, the investment will also accelerate the growing narrative about FAU's record of achievement.

II. Return on Investment - *Describe the outcome(s) anticipated, dashboard indicator(s) to be improved, or return on investment. Be specific. For example, if this issue focuses on improving retention rates, indicate the current retention rate and the expected increase in the retention rate. Similarly, if the issue focuses on expanding access to academic programs or student services, indicate the current and expected outcomes.*

Measures of Success

1. **Year-one accomplishment →** AI/Data enrollments
    a. Student credit hours in AI/Data courses
    b. Headcount in AI/Data programs
2. **ROI →** AI/Data student outcomes
    a. Degrees awarded in AI/Data
    b. Median salary of graduates from AI/Data programs
    c. Percent of graduates employed from AI/Data programs
3. **Year-one accomplishment →** AI/Data research grant proposal
4. **ROI →** AI/Data research expenditures
5. **Ranking →** *US News and World Report* national ranking

a. Top Public Schools

b. Undergraduate and graduate business programs

c. Undergraduate and graduate engineering ranks

Enhancing the State of Florida's reputation for research and excellence

Despite the fact that Florida is the third most populous state in the country, according to the National Science Foundation (NSF), the state only ranks 8th in federal research expenditures and 19th in industry R&D expenditures (https://www.nsf.gov/statistics/2018/nsb20181/data). The responsibility for positively impacting this figure has fallen on the backs of a select few preeminent institutions, as well as those that are designated as very-high research institutions in terms of their Carnegie Classifications by the Center for Postsecondary Research. This plan thrusts FAU forward from its current designation as a high research institution, helping the state with its standing in research funding, and stimulating the economy as it does so.

The National Institutes of Health (NIH) estimate that every "$1.00 increase in public basic research stimulates an additional $8.35 of industry R&D investment after 8 years" (https://www.nih.gov/about-nih/what-we-do/impact-nih-research/our-society). With the 2025 target of FAU reaching $200M in research expenditures, which is $172M increase from the baseline, the university projects that its efforts to expand its research enterprise will result in approximately $1.4 billion impact in private sector R&D by 2033.

This particular formula does not take into account the economic impact of the increased numbers of degrees awarded at a more efficient pace, or the likewise precipitous rise in the region's tertiary economy that supports the university, its employees, and its students. The exponential impacts of building a national university in the region are much more difficult to quantify. As the state builds yet another nationally-recognized university, its residents will also feel the impact with ancillary industries and high-paying jobs that co-locate with such institutions.

III. Facilities*:*

	Facility Project Title	Fiscal Year	Amount Requested	Priority Number
1.	N/A	N/A	N/A	N/A

2020-2021 Legislative Budget Request
Education and General
Position and Fiscal Summary
Operating Budget Form II
(to be completed for each issue)

University: **Florida Atlantic University**

Issue Title: **University of Distinction AI/Data - FAU100**

	RECURRING	NON-RECURRING	TOTAL
Positions			
Faculty	15.00	0.00	15.00
Other (A&P/USPS)	5.00	0.00	5.00
Total	20.00	0.00	20.00
Salary Rate (for all positions noted above)			
Faculty	$100,000	$0	$100,000
Other (A&P/USPS)	$75,000	$0	$75,000
Total	$175,000	$0	$175,000
Salaries and Benefits	$2,400,000	$0	$2,400,000
Other Personal Services	$7,400,000	$0	$7,400,000
Expenses	$8,300,000	$0	$8,300,000
Operating Capital Outlay	$0	$0	$0
Electronic Data Processing	$0	$0	$0
Special Category (Specific)	$0	$0	$0
	$0	$0	$0
	$0	$0	$0
	$0	$0	$0
Total All Categories	$18,100,000	$0	$18,100,000