Jarvis Academic Cyberinfrastructure for Data-Driven Sciences (JACiDS)

JARVIS
CHRISTIAN UNIVERSITY

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Institution: Jarvis Christian University (JCU)

Project Summary

The JACiDS project aims to transform Jarvis Christian University (JCU) into a regional hub for training and research in data-driven sciences. This initiative directly aligns with the NSF's mission to promote scientific discovery and innovation, especially within underserved institutions like Historically Black Colleges and Universities (HBCUs). By establishing a robust cyberinfrastructure, JCU will empower its students and faculty to engage with the growing demands of data-intensive fields, fostering a new generation of data scientists and researchers.

Intellectual Merit (1/2)

The JACiDS project addresses the pressing need to enhance data science capacity within HBCUs. By building a strong foundation in computational applied mathematics and providing state-of-the-art cyberinfrastructure, the project will contribute to:

- **Workforce Development:** Preparing students for lucrative careers in data science, machine learning, artificial intelligence, and other emerging fields, thereby addressing the national shortage of skilled data professionals.

Intellectual Merit (2/2)

- **Research Innovation:** Facilitating faculty research projects that leverage data-driven approaches to tackle real-world challenges in areas like healthcare disparities, social justice, environmental sustainability, and economic development relevant to the region.
- **Curriculum Enhancement:** Integrating data science concepts and tools into existing STEM programs, enriching the learning experience for all students and preparing them for the data-centric future.

Broader Impacts (1/2)

Beyond JCU, the JACiDS project will have far-reaching impacts:

- **Community Engagement:** Offering workshops, training programs, and outreach initiatives to local high schools, community colleges, and community organizations, promoting data literacy and STEM participation among underrepresented groups.
- **Economic Development:** Fostering collaborations with regional industries and government agencies to address data-driven challenges, contributing to the local economy and workforce development.

Broader Impacts (2/2)

- **Model for HBCUs:** Serving as a replicable model for other HBCUs seeking to strengthen their data science capabilities, thereby amplifying the national impact on diversifying the STEM workforce and broadening participation in research.

Project Description (1/4)

The JACiDS project consists of four interconnected tasks:

1. **Innovative Computational Applied Mathematics Engineering (ICAME) Program:**
    - Develop a rigorous interdisciplinary undergraduate program that blends applied mathematics, computational methods (e.g., numerical analysis, optimization, high-performance computing), and engineering principles with a focus on data science applications.
    - Recruit and train faculty in computational mathematics, data science, and machine learning pedagogies, ensuring expertise and capacity for effective teaching and mentoring.
    - Actively recruit students from diverse backgrounds, offering scholarships, targeted outreach, and bridge programs to ensure equitable access and success.
    - Incorporate research projects, internships, and industry collaborations for hands-on experience and career preparation.

Project Description (2/4)

2. Software Library Collection:

- Conduct a comprehensive needs assessment to identify essential software tools for data analysis, modeling, simulation, and machine learning (e.g., Python, R, Julia, MATLAB, TensorFlow, PyTorch, specialized libraries).
- Secure licenses and subscriptions for selected software packages, prioritizing open-source options where possible to minimize costs and ensure long-term sustainability.
- Install and configure software on campus servers and provide user-friendly access to students and faculty through a centralized portal or cloud-based environment.
- Offer regular workshops, tutorials, and online resources to train users on effective software utilization and best practices.

Project Description (3/4)

3. Zero-Tolerance Network Infrastructure:

- Design and implement a high-speed, reliable, and secure local area network (LAN) and wireless network to support data-intensive research and collaboration.
- Ensure sufficient bandwidth and low latency for data transfer, analysis, and storage, accommodating the demands of large datasets and computationally intensive tasks.
- Implement robust security measures, including firewalls, intrusion detection systems, and encryption protocols, to protect sensitive research data and prevent unauthorized access.
- Establish a dedicated IT support team to monitor network performance, troubleshoot issues, and provide timely assistance to users.

Project Description (4/4)

4. Secured Database System:

- Design and deploy a scalable and secure database system to store, manage, and protect sensitive research data generated by faculty and students.
- Consider both relational (e.g., PostgreSQL, MySQL) and NoSQL (e.g., MongoDB, Cassandra) database options, selecting the most appropriate technology based on the specific data types and research needs.
- Implement strict access controls, encryption, regular backups, and disaster recovery mechanisms to ensure data integrity, confidentiality, and availability.
- Provide training to faculty and students on database access, management, and security best practices.

Budget Justification

Personnel: Salaries and benefits for faculty, staff, and student assistants involved in program development, teaching, research, and infrastructure management.

Equipment: High-performance computing servers, networking equipment (switches, routers, access points), storage devices (hard drives, cloud storage), and software licenses/subscriptions.

Travel: Conference attendance, workshops, and training for faculty and students to stay abreast of the latest developments in data science.

Supplies and Services: Maintenance contracts, software updates, cybersecurity consulting, and other operational expenses.

Evaluation: Costs associated with assessing the project's impact, including surveys, focus groups, data analysis, and external evaluation consultants.

Project Timeline

Year 1: ICAME program curriculum development, faculty recruitment and training, software library needs assessment and acquisition, network design and procurement.

Year 2: ICAME program launch and initial student cohort, software library deployment and training, network infrastructure implementation and testing, database system design and selection.

Year 3: ICAME program expansion and refinement, database system deployment and data migration, ongoing network maintenance and security enhancements, initial project evaluation and assessment.

Years 4-5: Continuous program improvement, faculty research project initiation, community engagement and outreach, dissemination of project findings and best practices, comprehensive project evaluation and final report.

Evaluation Plan

The project's success will be assessed through a combination of quantitative and qualitative measures, including:

- **Quantitative:** Number of students enrolled and graduated from the ICAME program, student performance on standardized assessments and coursework, faculty publications and presentations, research grants secured, software usage statistics, network performance metrics, database utilization, and number of community members reached through outreach activities.
- **Qualitative:** Surveys and focus groups with students, faculty, community partners, and industry collaborators to assess program satisfaction, skill development, research productivity, career outcomes, and perceived impact on the institution and broader community.

Key Personnel

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Other Key Personnel: Faculty members with expertise in applied mathematics, computer science, data science, engineering, statistics, and relevant domain areas (e.g., healthcare, social sciences, environmental science). External consultants for cybersecurity, network infrastructure, and database management.

Conclusion

The JACiDS project represents a transformative opportunity for Jarvis Christian University to become a leader in data-driven education and research within the HBCU community and beyond. By investing in cyberinfrastructure and human capital, this project will empower students, faculty, and the broader community to harness the power of data for scientific discovery, innovation, societal advancement, and economic development.