Proposed Computational Sciences Research Center
Strategic Plan
Spring 2001

Mission

The Computational Sciences Research Center engages in the fundamental and applied research and graduate educational activities required to create and disseminate the knowledge of problem solving using computers.

Vision

The Computational Sciences Research Center will be recognized as one of the top research centers in the nation.

Goals

Academic and Research Excellence is the flagship goal, critical to the success of the Computational Sciences Research Center. Other primary goals of the Center are ***Access and Diversity, Partnerships,*** *and* ***Resources and Infrastructure.***

The center is to be comprised of three interdisciplinary focus areas: Data Understanding, Human-Centered Computing, and Computational Mechanics and Materials and one intradisciplinary focus area on Declarative Languages and Automated Reasoning. All focus areas share the goals above. Objectives, Critical Success Factors and individual mission and vision statements are given below with proposed focus areas of the center.

Proposed Focus Areas

1   Data Understanding

1.1   Mission

The Data Understanding Focus Area will facilitate and direct interdisciplinary research concerning novel and revolutionary approaches to data and knowledge representation and mining of large databases containing macro and micro data.

1.2   Vision

The Center will pursue the fundamental and applied research directions necessary to develop revolutionary techniques for the distillation of large data sets into small theoretical and/or algorithmic units to assist humans in understanding massive data sets. The center will focus on fundamental efforts in knowledge representation, information complexity, and declarative languages. The Center will apply these results to hard problem domains, to understand biological (both population and genomic), geographical, and engineering data sets.

1.3 Goals

Academic and Research Excellence is the flagship goal, critical to the success of the Computational Sciences Research Center. Other primary goals of the Center are ***Access and Diversity, Partnerships,*** and ***Resources and Infrastructure.***

Objectives.
1. Obtain Computer Science Faculty positions in complexity and program synthesis.
2. Obtain space in the lab sciences building to house research labs.
3. Obtain state-of-the-art networked computer resources to house very large data sets of interest to the domain experts.
4. Obtain key faculty positions in biology, geology, and petroleum engineering to focus on solving key problems using very large networked data resources.
5. Forge ties with external institutes focused on similar research (e.g., Santa Fe Institute).

Critical Success Factors.
1. Obtain $300,000 in university excellence funding.
2. Increase federal research support from NIH, NSF, NASA, and DoD to $2,500,000 per year.
3. Develop special courses in computer science graduate studies concerning knowledge representation and data understanding.
4. Forge ties among departments identified.

5. Have 8 tenure track faculty members devoted to data understanding among identified departments.

2   Human-Centered Computing

2.1   Mission
The Human-Centered Computing Focus Area will facilitate and direct interdisciplinary research concerning novel and revolutionary approaches to the seamless interaction of dry and wet intelligent agents.

2.2   Vision
The Center will pursue the fundamental and applied research directions necessary to develop revolutionary techniques for human-centered computing. Human-centered computing research is meant to result in systems that take into account the level of intelligence and capability of the systems deployed, together with the cognitive and perceptual abilities of the humans using these systems – resulting in optimal systems of humans and machines where the machines do what they do best, freeing humans to do the more creative activities that they do best. The center will develop formal approaches to the specification of human and software intelligent agents for the purpose of understanding the interactions among them. Another focus will be on multimodal interfaces that work towards seamless interactions between humans and machines.

2.3 Goals

Academic and Research Excellence is the flagship goal, critical to the success of the Computational Sciences Research Center. Other primary goals of the Center are ***Access and Diversity, Partnerships,*** *and* ***Resources and Infrastructure.***

Objectives.
1. Obtain Computer Science Faculty positions in multimodal interface designs and intelligent agents.
2. Obtain space in the lab sciences building to house research labs.
3. Obtain state-of-the-art lab for the development of new interfaces.
4. Obtain key faculty positions in psychology, the medical school, and industrial engineering to focus on solving key problems of understanding and specifying human characteristics.
5. Forge ties with external institutes focused on similar research (e.g., Institute for Human and Machine Cognition).

Critical Success Factors.
1. Increase federal research support from NIH, NSF, NASA, and DoD to $2,500,000 per year.

2. Obtain $300,000 in university excellence funding.
3. Forge ties among departments identified.
4. Have 6 tenure track faculty members devoted to human centered computing among identified departments.

3   Computational Mechanics and Materials

3.1   Mission

The Computational Mechanics and Materials Focus Area will facilitate and direct interdisciplinary research concerning novel and revolutionary approaches the development of parallel codes to model mechanical and chemical systems.

3.2   Vision

The Center will pursue the fundamental and applied research directions necessary to develop revolutionary techniques for parallel computing. Approaches to automatically devise parallel problem solutions from high level specifications will be developed and implemented in a compiler. New models of mechanical and chemical processes will be developed.

3.3 Goals

Academic and Research Excellence is the flagship goal, critical to the success of the Computational Sciences Research Center. Other primary goals of the Center are ***Access and Diversity, Partnerships,*** and ***Resources and Infrastructure.***

Objectives.
1. Obtain a Computer Science Faculty position in networked and distributed parallel systems.
2. Obtain space in the lab sciences building to house research labs.
3. Obtain key faculty positions in mechanical and chemical engineering to focus on model and algorithm development.
4. Forge ties with external institutes focused on similar research.

Critical Success Factors.
1. Increase federal research support from DOE, DARPA, NSF, NASA, and DoD to $1,500,000 per year.
2. Obtain $250,000 in university excellence funding.
3. Forge ties among departments identified and the Reese HPCC.
4. Have 8 tenure track faculty members, among identified departments, devoted to high performance computing.

4. Declarative Languages

4.1 Mission

The Declarative Languages Focus Area will facilitate and direct intradisciplinary research concerning novel and revolutionary approaches to intuitive abstractions for the construction of symbolic and numerical computations.

4.2 Vision

The center will develop hybrid approaches to the specification of symbolic and numerical computations leading to revolutionary languages that will better address data understanding, human-centered computing, parallel computations, and autonomous systems. Through empirical and theoretical investigations of A-Prolog and SequenceL new language approaches will be developed.

4.3 Goals

Academic and Research Excellence is the flagship goal, critical to the success of the Computational Sciences Research Center. Other primary goals of the Center are *Access and Diversity, Partnerships,* and *Resources and Infrastructure.*

Objectives.
1. Obtain Computer Science Faculty positions in functional and logic programming.
2. Obtain space in the lab sciences building to house research labs.
3. Forge ties with external institutes focused on similar research (e.g., TAG and Stanford).

Critical Success Factors.
1. Increase federal research support from NSF, NASA, and DoD to $750,000 per year.
2. Obtain $250,000 in university excellence funding.
3. Increased national and international visibility in declarative language development.