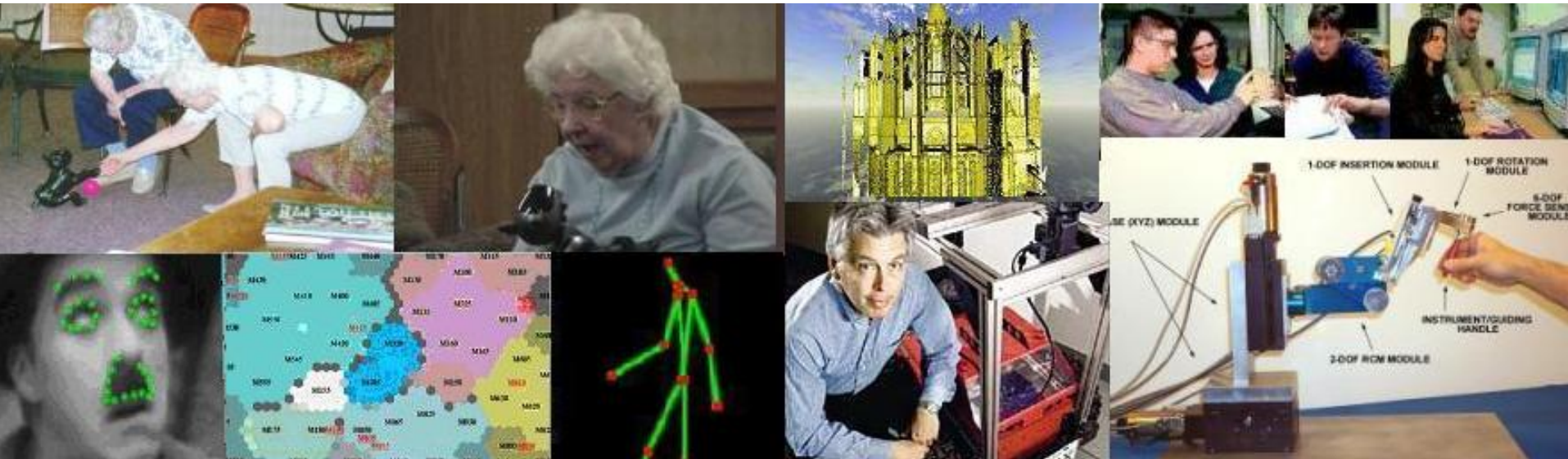# Information and Intelligent Systems

Increasing the capabilities of human beings and machines to create, discover and reason with knowledge by supporting research to advance the ability to represent, collect, store, organize, locate, visualize and communicate information.

IIS Research & Education Activities

CURRENT PROGRAMS:
Artificial Intelligence and Cognitive Science
Digital Society and Technologies
Human Language and Communication
Human-Computer Interaction
Information and Data Management
Robotics and Computer Vision
Special Projects (Digital Libraries)
Universal Access
NEW AREAS:
Science and Engineering Informatics
Digital Government
Computational Neuroscience
6 NSF Priority Areas

Artificial Intelligence and Cognitive Science

The AICS program focuses on

Advancing the state of the art in Artificial Intelligence and Cognitive Science

Research fundamental to the development of computer systems capable of performing a broad variety of intelligent tasks and to the development of computational models of intelligent behavior across the spectrum of human intelligence.

AICS

Examples of performance-oriented topics include intelligent agents, planning, automated reasoning, machine learning, case-based reasoning, knowledge representation methodologies, and architectures for combining intelligent tasks such as perception, reasoning, planning, learning, and action.

Examples of cognitive-oriented topics include analogical reasoning, concept formation and evolution, argumentation, integration of knowledge from diverse sources and experience, knowledge acquisition by human learners, manipulation and development of taxonomies and classification systems, collaborative behavior, and adaptation and learning.

Digital Society and Technologies

–**Advancing the knowledge frontier related to living, working, learning and being healthy in a digital society**

–**Integrating technical and social theories, concepts, methods, mechanisms, and/or design principles to sustain and build research areas at the interstices of the social and the technical**

–**Creating a coherent interdisciplinary community of practice doing research on the digital society.**

Current research areas include:

1. Universal Participation in a Digital Society

2. Collaborative Intelligence

3. Management of Knowledge Intensive Enterprises

4. Knowledge Environments for Science and Engineering

5. Transforming Enterprise

Human Language and Communication

The HLC program focuses on:

Advancing the state of the art in text and speech processing, as well as in multi-modal communication.

Research fundamental to the development of computer systems capable of analyzing, understanding, and generating language, speech, and other forms of communication that humans use naturally across a wide variety of situations.

HLC

The HLC program's ultimate objective is to transform the human-computer communication experience so that users can address a computer at any time and any place as though they were addressing another person.

The HLC program seeks highly innovative proposals aimed at advancing the ability to test new theories and develop new computational models of all aspects of human language and communication.

Human-Computer Interaction

Supports research fundamental to the design and evaluation of systems that mediate between computers and humans, for the creation of tomorrow's exciting new user interface software and technology.

Ultimate objective is to transform the human-computer interaction experience, so the computer is no longer a distracting focus of attention but rather an invisible tool that empowers the individual user.

HCI

HCI research topics include: development and evaluation of models and theories; augmented cognition; novel uses of computers in education; multi-media and multi-modal interfaces in which combinations of text, graphics, gesture, movement, touch, sound; intelligent interfaces; information visualization; virtual and augmented reality; immersive environments; wearable, mobile, and ubiquitous computing; and new I/O devices.

Information and Data Management

Research fundamental to the design, implementation, development, management, and use of databases, information retrieval, and knowledge-based systems.

Topics include design methodologies, data, metadata, information, knowledge and process/event modeling, information access and interaction, information integration, knowledge discovery and visualization, and systems architecture and implementation.

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IDM

Research areas span web-based systems, novel data types, scientific and engineering databases, efficient data gathering and storage, information organization and management, security/privacy issues, information flow, dynamic/evolutionary systems, change maintenance, information life-cycle management, interoperability in heterogeneous systems, scalable distributed/mobile information systems, and performance issues.

Robotics and Computer Vision

ROBOTICS: to develop novel ideas into projects that have the potential to lead to advanced, intelligent robotic systems.

Supports fundamental research in robotics, i.e., machines with sensing, intelligence, and mobility.

Emphasis is on systems operating in unstructured environments with uncertainty; cooperation of humans and robots; advanced robotic sensory systems.

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COMPUTER VISION: advanced visual perception and intelligent systems.

Supports fundamental research in computer vision.

Emphasis is on image representation and interpretation for systems designed to infer properties of the environment from imaging data, and advanced vision systems providing cognitive abilities.

Special Projects (Digital Libraries)

…to dramatically advance the means to collect, store, and organize information in digital forms, and make it available for searching, retrieval, and processing via communication networks -- all in user-friendly ways

…to create information systems that can operate in multiple languages, formats, media, and social and organizational contexts

SP/DL

A 10-year cooperative effort…

DLI Phase 1: 1994-1998

DLI Phase 2: 1999-2004

International Digital Libraries Collaborative Research: 1999-

International Digital Libraries Collaborative Research and Applications Testbeds: 2002-

No current competitions, but research to enable diverse digital libraries will continue to be supported by IIS.

Universal Access

Fundamental research in computer science that advances computer systems technology so that all people can possess the skills needed to fully harness the power of computing.

The mission is to empower people with disabilities, young children, seniors, and members of other traditionally under-represented groups, so that they are able to participate as first-class citizens in the new information society.

UA

Topics include: development of new models, architectures, and programming languages that emphasize interface speed and usability by all; definition of semantic structures for multimedia information to support cross-modal I/O; development of specific solutions to address the special needs of UA user communities; and experimental studies to evaluate the success of attempts to provide access in all its varied forms.

Science and Engineering Informatics

Advancing the state of the art in domain informatics – advanced IT for specific domain science and engineering problems.

To maximally exploit data and information.

Data management & analysis tools common to individual domains.

Intersection of domain informatics for generic infrastructure and tools of specific use in particular domains.

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SEI

SEI is distinguished from the other core programs in the Division of Information and Intelligent Systems (IIS) in three fundamental ways: (a) it is integrative – interoperability is fundamental and drives the program; (b) it is focused on tools and analysis; and (c) it provides the data infrastructure for science and engineering. SEI is a cross-disciplinary program and international cooperation is encouraged.

Digital Government

Government is a major collector and provider of data and information, a provider of information-based service and a user of information technologies. The research goals of the Digital Government Program are to support:

1) multi-disciplinary and multi-sector partnerships of researchers in information technologies and government agencies at all levels in order to foster collaboration among societal sectors, and…

DG

2) research on the relationships between the design and use of information technologies on:

i) forms, processes, and outcomes of democracy,

ii) government organizational forms, learning, and adaptation,

iii) new forms of government-government collaboration,

iv) citizen/government interaction, and

v) other social/political science research related to IT and government

Data and Applications Security

A 2002 competition, expected to be part of broader competitions in future.

In response to the emerging security threats, DAS supported research on:

Secure Database Systems

Secure Digital Libraries

Secure Semantic Web

Data Mining for Security

DAS

Technical areas of 2002 competition:

Secure Database Systems

Inference and Aggregation

Security for Multimedia Database Applications

Secure Digital Libraries

Secure Semantic Web

Quality of Service for Secure Database Applications

Data Mining Applications in Information Security

Computational Neuroscience

Joint NSF/NIH Initiative to Support Collaborative Research in Computational Neuroscience (CRCNS)

NSF Directorates: Biological Sciences; Computer And Information Science and Engineering; Engineering; Social, Behavioral, And Economic Sciences; Mathematical and Physical Sciences

NIH Institutes: Mental Health; Neurological Disorders and Stroke; Drug Abuse; Aging; Deafness and other Communication Disorders; Alcohol Abuse and Alcoholism; Eye Institute; Biomedial Imaging and Bioengineering; Dental and Craniofacial Research

CNS

Computational neuroscience provides a theoretical foundation and set of technological approaches that may enhance our understanding of nervous system function by providing analytical and modeling tools that describe, traverse and integrate different levels of organization, spanning vast temporal and spatial scales.

Collaborations among computer scientists, engineers, mathematicians, theoreticians and neuroscientists, are imperative to advance our understanding of the nervous system.

NSF Priority Areas

Information Technology Research

Research on software, networking, scalability, and communications to improve ways to gather, store, analyze, share, and display information.

Nanoscale Science and Engineering

Explores phenomena at molecular and atomic scales and new techniques to facilitate a broad range of applications.

Biocomplexity in the Environment

Investigates interactions among ecological, social and physical earth systems.

NSF Priority Areas

Learning for the 21st Century Workforce

Expands our fundamental knowledge base on learning, explores the potential of information technology to facilitate and enhance learning, and integrates new understanding of learning and technology into formal and informal educational settings.

Mathematical Sciences

Fundamental mathematical and statistical research, collaboration between the mathematical sciences and other disciplines, and mathematics education.

Human and Social Dynamics

Understanding of the causes and ramifications of change, the dynamics of behavior and the human mind, and the cognitive and social structures that create and define change.