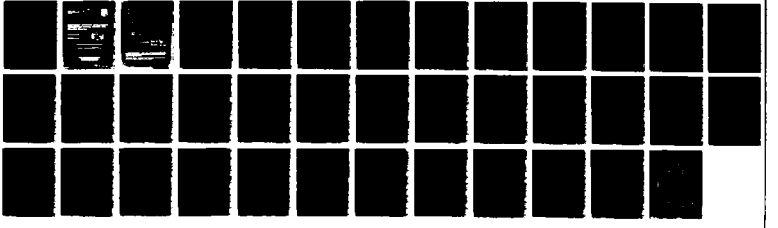
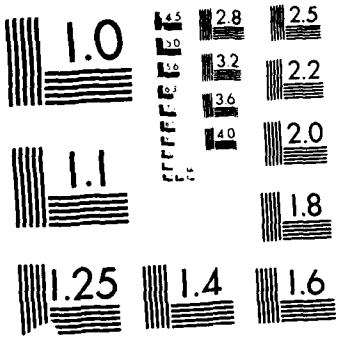
AD-A190 005 NORTHEAST ARTIFICIAL INTELLIGENCE CONSORTIUM ANNUAL REPORT FOR 1986 VOLUME 1 EXECUTIVE SUMMARY(U) SYRACUSE UNIV NY V WEISS ET AL. JUN 88 RADC-TR-88-11-VOL-1 1/1

UNCLASSIFIED F30602-85-C-0008 F/G 12/9 NL





UTION TEST CHART

(4)

AD-A198 085

DTIC FILE COPY

RADC-TR-88-11, Vol I (of eight)
Interim Technical Report
June 1988

NORTHEAST ARTIFICIAL INTELLIGENCE CONSORTIUM ANNUAL REPORT 1986 Executive Summary

Syracuse University

Hillel Weiss and James F. Shea

DTIC
ELECTE
AUG 11 1988
S D

This report has been reviewed by the RADC Public Affairs Office (PA) and is releasable to the National Technical Information Service (NTIS). At NTIS it will be releasable to the general public, including foreign nations.

RADC-TR-88-11, Vol I (of eight) has been reviewed and is approved for publication.

APPROVED: Donald J. Gondek

DONALD J. GONDEK
Project Engineer

APPROVED: Raymond P. Urtz Jr.

RAYMOND P. URTZ, JR.
Technical Director
Directorate of Command & Control

FOR THE COMMANDER: John A. Ritz

JOHN A. RITZ
Directorate of Plans & Programs

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS N/A
2a. SECURITY CLASSIFICATION AUTHORITY N/A	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution unlimited.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE N/A	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) N/A	5. MONITORING ORGANIZATION REPORT NUMBER(S) RADC-TR-88-11, Vol I (of eight)
6a. NAME OF PERFORMING ORGANIZATION Northeast Artificial Intelligence Consortium (NAIC) 6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION Rome Air Development Center (COES)
6c. ADDRESS (City, State, and ZIP Code) 409 Link Hall Syracuse University Syracuse NY 13244-1240	7b. ADDRESS (City, State, and ZIP Code) Griffiss AFB NY 13441-5700
8a. NAME OF FUNDING/SPONSORING ORGANIZATION Rome Air Development Center 8b. OFFICE SYMBOL (If applicable) COES	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER F30602-85-C-0008
8c. ADDRESS (City, State, and ZIP Code) Griffiss AFB NY 13441-5700	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. 62702F; PROJECT NO. 5581; TASK NO 27; WORK UNIT ACCESSION NO. 13

11. TITLE (Include Security Classification)
NORTHEAST ARTIFICIAL INTELLIGENCE CONSORTIUM ANNUAL REPORT 1986 Executive Summary

12. PERSONAL AUTHOR(S)
Volker Weiss, James F. Brule'

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Interim	FROM Jan 86 TO Dec 86	June 1988	44

16. SUPPLEMENTARY NOTATION
This effort was funded partially by the Laboratory Directors' Fund.

17. COSATI CODES		
FIELD	GROUP	SUB-GROUP
12	05	
12	07	

18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
Artificial Intelligence, Problem Solving, Expert Systems, Speech Understanding, Distributed AI, Machine Vision

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

The Northeast Artificial Intelligence Consortium (NAIC) was created by the Air Force Systems Command, Rome Air Development Center, and the Air Force Office of Scientific Research. Its purpose is to conduct pertinent research in artificial intelligence and to perform activities ancillary to this research. This report describes progress that has been made in the second year of the existence of the NAIC on the technical research tasks undertaken at the member universities. The topics covered in general are: versatile expert system for equipment maintenance, distributed AI for communications system control, automatic photo interpretation, time-oriented problem solving, speech understanding systems, knowledge base maintenance, hardware architectures for very large systems, knowledge-based reasoning and planning, and a knowledge acquisition, assistance and explanation system.

This volume provides the executive summary of all work done by the NAIC in 1986.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	UNCLASSIFIED
22a. NAME OF RESPONSIBLE INDIVIDUAL Donald J. Gondek	22b. TELEPHONE (Include Area Code) (315) 330-4833 22c. OFFICE SYMBOL RADC (COES)

DD Form 1473, JUN 86 *Previous editions are obsolete.*

Item 10. SOURCE OF FUNDING NUMBERS (Continued)

Program Element Number	Project Number	Task Number	Work Unit Number
62702F	4594	18	E2
61101F	LDFP	15	C4
61102F	2304	J5	01
33126F	2155	02	10

Item 18. SUBJECT TERMS (Continued)

Knowledge Based Systems,
Planning Knowledge Acquisition,
Logic Programming (GJLD)

Table of Contents

1. INTRODUCTION

1.1 The Northeast Artificial Intelligence Consortium

The Northeast Artificial Intelligence Consortium (NAIC) began as a group of eight institutions of higher learning organized for the purpose of developing research and education in artificial intelligence (AI) in the northeastern area of the United States. Currently, the participating institutions are:

State University of New York at Buffalo, Buffalo NY
Clarkson University, Potsdam NY
The University of Massachusetts at Amherst, Amherst MA
Rensselaer Polytechnic Institute, Troy NY
The University of Rochester, Rochester NY
Rochester Institute of Technology, Rochester NY
Syracuse University, Syracuse NY

Additionally, Colgate University (Hamilton NY) was an original member institution, but withdrew from the Consortium owing to the departure of its senior researcher, Dr. Sergei Nirenburg, to Carnegie-Mellon University. Their contributions will be missed.

1.2 Objectives of the Consortium

The member institutions represent both public and private schools, varying greatly in size and academic thrust. Much work has been devoted to realizing a working management structure originally conceptualized in the first year; pursuing the technical tasks of the individual institutions; refining the ancillary goals of the Consortium as work proceeds towards these objectives; and continuing to foster cooperation between the faculties of the Consortium institutions.

Researchers at each institution have their own expertise and interests, and are addressing a varied group of problems in AI that are of interest to the Air Force. Each of these problems has been viewed as a more or less distinct task, and as such each research group submitted to the Consortium a complete report covering the research task or tasks undertaken during the past year. Summaries of their work are included in the volumes that follow this one.

The topics under study and the Principal Investigators ("PIs") at each institution are:

VMES: A NETWORK-BASED VERSATILE MAINTENANCE EXPERT SYSTEM

PIs: Stuart C. Shapiro, Sargur N. Srihari
Department of Computer Science
State University of New York at Buffalo
Buffalo, NY 14260
(Volume II)

DISTRIBUTED PROBLEM SOLVING

PIs: Susan E. Conry, Robert A. Meyer
Electrical and Computer Engineering
Clarkson University
Potsdam, NY 13676
(Volume III)

AUTOMATIC PHOTO INTERPRETATION

PI: James W. Modestino
Electrical, Computer, and Systems Engineering Department
Rensselaer Polytechnic Institute
Troy, NY 12180-3590
(Volume IV)

PLAN RECOGNITION, KNOWLEDGE ACQUISITION, AND EXPLANATION IN AN INTELLIGENT USER INTERFACE

PIs: Victor Lesser, W. Bruce Croft, and Beverly Woolf
Department of Computer and Information Science
The University of Massachusetts at Amherst
Amherst, MA 01003
(Volume V)

COMPUTER ARCHITECTURES FOR VERY LARGE KNOWLEDGE BASES

PI: P. Bruce Berra
Electrical and Computer Engineering
Syracuse University
Syracuse, NY 13244-1240
(Volume VI-a)

KNOWLEDGE BASE MAINTENANCE USING LOGIC PROGRAMMING METHODOLOGIES

PI: Kenneth A. Bowen
School of Computer and Information Science
Syracuse University
Syracuse, NY 13244-1240
(Volume VI-b)

SPEECH UNDERSTANDING RESEARCH

PIs: Harvey Rhody
RIT Research Corporation
Rochester, NY 14623
and
John A. Biles
Computer Science Department
Rochester Institute of Technology
Rochester, NY 14623
(Volume VII)

TIME-ORIENTED PROBLEM SOLVING

PI: James F. Allen
Computer Science Department
The University of Rochester
Rochester, NY 14627
(Volume VIII-a)

PARALLEL, STRUCTURAL, AND OPTIMAL TECHNIQUES IN VISION

PI: Christopher M. Brown
Computer Science Department
The University of Rochester
Rochester, NY 14627
(Volume VIII-b)

Information on the task undertaken at Colgate University, "Planner System for the Application of Indications and Warning," (Principal Investigator: Sergei Nirenburg) is contained elsewhere in this volume.

While the technical tasks were unique to each participating institution, the ancillary goals were commonly agreed to, despite the fact that there were varying degrees of accomplishment at each institution. The primary ancillary goals were to develop greater AI expertise at the university level and to enhance the external recognition

of the Consortium and its members. The vehicles for accomplishing these goals were seen to be as follows:

1. expanding faculties
2. increasing the number of graduate students
3. increasing the number of AI courses
4. improving facilities

The pursuit of the remaining ancillary goals was viewed to be useful in the fulfillment of the primary objective as well. These remaining goals are:

1. encouraging and supporting industrial participation in AI
2. expanding funding support
3. developing an active AI community

Some of these goals and objectives (such as recruiting more students and faculty, improving facilities, and fostering a working relationship with industry) are driven largely by individual institutions. Despite this, the Consortium has begun to be of great help in propagating the name and image of both the Consortium and its individual members: by fostering interaction between its members, speaking on behalf of the entire Consortium, and sponsoring workshops, symposia, and other events. Progress in each of these areas ultimately affects all the others, since each of these subgoals is intertwined with the ultimate mission of the Consortium.

2. MANAGEMENT STRUCTURE

2.1 Inter-School

Director: Bradley J. Strait (to August 10, 1986), Volker Weiss
Program Manager: Robert F. Cotellessa (to September 1986)
Administrative Assistant: Andrea Pflug
Committees: Executive Committee elected July 9, 1986:
UMass (2 years).....Prof. Croft
SUNY Buffalo (2 years)..Prof. Shapiro
U of Rochester (1 year)...Prof. Allen
RPI (1 year).....Prof. Modestino

The Project Director is the responsible individual named in the prime contract with Syracuse University and maintains liaison with other administrative offices at that University. Syracuse has subcontracted with the other universities in the NAIC. The Program Manager is responsible for the operational activities of the NAIC and the Administrative Assistant works primarily with the Program Manager and interfaces

with the Project Director. The Project Director and Program Manager have maintained a close working relationship and often have participated jointly in NAIC activities and in acting as liaison with RADC. The Program Manager's responsibilities include the preparation of reports, organization of NAIC meetings, briefings at Consortium and University locations, establishment of committees and advisory boards, facilitation of networking arrangements, arrangements for vendor presentations, organization of educational efforts and seminars in Rome, New York, assistance in constructing a master's degree curriculum that emphasizes AI, and making preparations for creating a legal entity.

2.2 Intra-school

The Principal Investigator(s) (PIs) at each institution is responsible for both the technical and ancillary functions at the respective institution. The PI's are as follows:

Stuart C. Shapiro and Sargur N. Srihari
State University of New York at Buffalo (SUNY/Buffalo)

Susan E. Conry, Robert A. Meyer and Janice E. Searleman
Clarkson University

Sergei Nirenburg
Colgate University

Victor Lesser, W. Bruce Croft, and Beverly Woolf
University of Massachusetts at Amherst (UMass)

James W. Modestino and George Nagy (originally Herbert Freeman)
Rensselaer Polytechnic Institute (RPI)

James F. Allen
University of Rochester (UofR)

Harvey Rhody and John Biles
Rochester Institute of Technology (RIT)

P. Bruce Berra and Kenneth A. Bowen
Syracuse University

3. TECHNICAL TASKS

Detailed descriptions of research tasks under investigation at each of the member institutions of the Consortium are found in subsequent volumes. Short descriptions of the current year's research at each institution and their plans for the next year follow.

3.1 VMES: A Network-based Versatile Maintenance Expert System

State University of New York at Buffalo
Principal Investigators:
Stuart C. Shapiro, Sargur N. Srihari

This research is concerned with methods of developing a Versatile Maintenance Expert System (VMES). This would be a system that could interact with a maintenance technician and aid in the diagnosis of a faulty device. The aspects of "versatility" which are dealt with include: the ability to diagnose new devices for which technicians are not yet trained; devices which have not had extensive automated testing facilities designed; the ability to diagnose specific devices within certain "families" of devices; and the ability to interact flexibly with users.

Accomplishments by the project team are discussed in detail in Volume II.
Future plans include:

1) converting SNePS from Franz Lisp (on VAXes under UNIX) to Common Lisp (on TI Explorers)
2) beginning to convert VMES to the Explorers
3) investigation of the cognitive background of the interface task in VMES
4) additions to the interface, including the representation via pictures instead of objects
5) dissertation draft written and developed by James Geller
6) investigation of the incorporation of physical structure representation of devices into VMES
7) completion of Mingruey R. Taie's dissertation, "Representation of Device Knowledge for Versatile Fault Diagnosis"

3.2 Distributed Problem Solving

Clarkson University
Principal Investigators:
Susan Conry, Robert Meyer

The research project at Clarkson is designed to answer fundamental questions about the use of knowledge-based systems in communications network management and control. An architecture for a diversely distributed, multi-agent system has been developed in which each component is a specialized and localized knowledge-based system designed to provide assistance to the human operator and to cooperate with similar such systems performing other functions, and/or located in physically separate facilities. Further, a model for communications system management has been developed, based on the Defense Communications System (DCS) in Europe, and three fundamental types of knowledge-based problem solving activities required have been identified:

1) data interpretation and situation assessment
2) diagnosis and fault isolation
3) planning for resource allocation.

At present a Distributed AI System (DAISY) testbed has been implemented, incorporating two system building tools which they developed during this effort: SIMULACT (a generic tool for simulating multiple actors in a distributed AI system) and GUS (a graphical user interface which assists a user in capturing structural knowledge about a communications system). Significant progress has been made in designing a distributed planner, leading to a new problem solving paradigm called "Multistage Negotiation."

3.3 Automatic Photo Interpretation

Rensselaer Polytechnic Institute
Principal Investigator:
James W. Modestino

This task has been centered around the evolution of an approach to the development of an expert system for automated photointerpretation. This has included (beyond the requisite literature review) the development of new and improved low-level image processing concepts, consideration of appropriate data and control structures, and the evaluation of promising inference mechanisms. A major portion of the work has been directed toward the development of a testbed which will serve the role of allowing for the demonstration of well-defined and developed concepts, while at the same time serving as a development tool in exploring and testing new concepts.

There have been a number of attempts to date to develop limited-domain vision systems which provide semantic interpretations of raw data. In most cases there are vast differences in domain, the nature of the raw image data, the purpose, and the

use of world knowledge. This project anticipates working with medium- to high-altitude monochrome imagery data.

This imagery will include a variety of industrial, agricultural, military, residential, commercial, natural, and man-made objects. The goal is to be able to consistently segment the raw image data into distinct regions and provide a semantic description of these regions. This semantic description will specifically designate regions corresponding to a relatively small number of relevant objects, together with a number of more general categories corresponding to objects which are either irrelevant, or for which no unambiguous interpretation can be provided. For each of the relevant objects a knowledge database will be maintained which contains not only pertinent information for each object, but also the spatial relationships between them.

While initial development efforts have included only relatively primitive world knowledge, the plan is to provide flexibility for future expansion. For example, the present raw image database does not include any ground truth; in the future, map data may be included to aid in the photointerpretation process. Another possibility would be to use a previously interpreted image of the same scene as a guide in interpreting changes from one image to the next. Finally, the possibility of using either 2-D or 3-D models of relevant objects to aid in the photointerpretation process has not been ruled out.

3.4 Plan Recognition, Knowledge Acquisition, and Explanation in an Intelligent User Interface

The University of Massachusetts at Amherst
Principal Investigators:
W. Bruce Croft, Victor Lesser, Beverly Woolf

The major focus of the research at the University of Massachusetts has been the development of interfaces that support cooperating computer users in their interactions with a computer. These interfaces have been designed to help people complete tasks and to provide explanations while users engage in their activities. The research team has been building interfaces that contain both knowledge about typical methods used by people to achieve tasks and knowledge about how to recognize the users' plans. This work has involved research into planning, plan recognition, knowledge acquisition, and cooperative problem solving.

The work in planning and plan recognition has included significant additions to the POISE interface system and the design of an extended new framework called GRAPPLE. Among the additions made to POISE, a semantic database for representing objects of the domain was built. Additionally, a multistage negotiation

paradigm for planning in a distributed environment was developed, and explored in the domain of monitoring and controlling a complex communications system.

As part of a Ph.D. dissertation, a system was built to engage an expert in a dialogue about which of several interpretations of knowledge are intended for inclusion into a knowledge base. Finally, intelligent tutoring systems were built using multiple experts to encode individual teaching and learning expertise.

3.5 Computer Architectures for Very Large Knowledge Bases

Syracuse University
Principal Investigator:
P. Bruce Berra

The long-term goal of this project is to develop innovative computer architectures that effectively manage very large knowledge bases (VLKB) in a real-time environment. The context of the research is that of logic programming: that is, the inferencing mechanisms are written in a logic programming language with the rules and facts as Horn clauses. Current investigations have focused on three related areas:

1) the development of techniques for accessing the extensional database (EDB) of facts in minimum time
2) the development of parallel computer architectures that can further speed up EDB processing
3) optical processing of the EDB

Plans for the next year include concentrating on the design of a back end system to make use of parallel architectures, and on the optical approach to processing. Considerable efforts will be expended to explore the interface between logic programming and relational database management. Plans for subsequent years revolve around demonstrating a back end system that contains special hardware for the management of the EDB, having been integrated with the front end logic programming system under development by Dr. Kenneth Bowen at Syracuse University. Following that, the plan is to develop a prototype system that is designed to address the more global issues involved in the management of very large knowledge bases in a real time environment.

3.6 Knowledge Base Maintenance using Logic Programming Methodologies

Syracuse University
Principal Investigator:
Kenneth Bowen

The ongoing work of this project focused on the development of extensions for the logic programming language Prolog which are suitable for implementing complex artificial intelligence applications, including that of maintaining consistency and logical structure for large dynamic knowledge bases. The project is developing a quite high-level language which generates codes which appears to be efficient enough to treat substantial real-world applications. The developing semantics are able to draw on mathematical logic. The language being developed--metaProlog--is an extension of the AI programming language Prolog. The pattern of research is an interplay between the three major concerns: extending the language's expressability, proving the implementation feasibility of the extensions, and developing semantics to support the extensions.

Work this year focused primarily on proving the feasibility of efficient implementations of the extended metaProlog language which had been developed during previous years. The focus was on the development of an abstract theory of compilation and execution of extended Horn clause languages, together with work towards the construction of a prototype implementation. The results obtained this year indicate that a highly expressive extension of Prolog is indeed efficiently implementable and will possess a valuable semantics. During the next year, we will attempt a complete prototype implementation, as well as initiate a cycle of exploratory AI applications studies and semantics studies building on the present basis.

3.7 Speech Understanding Research

Rochester Institute of Technology
Principal Investigator:
Harvey Rhody

The guiding philosophy of this project centers on the contention that it is possible for humans to reliably "read" speech spectrograms. The overall goal, then, is to design and implement a knowledge-based system that reads speech specters. The architecture for this system is proceeding on both "virtual" (software) and "physical" (hardware) levels. Emphasis to date has proceeded on the former, but the acquisition of TI Explorers by the Consortium has fueled efforts in the latter as well.

The software architecture for the system is highly modular and largely data-driven. Work is proceeding in this manner both for pragmatic reasons of implementation and porting, as well as to leave open the ability to address parallel and blackboard architectures for control. Virtual architecture areas under investigation include an overall software architecture, spectral segmentation, low-level feature extraction, and phoneme building.

Future directions involve moving the system from Sun hardware to the TI Explorer/Odyssey board environment, allowing movement into higher level recognition modules. Also planned is work at exploiting the parallelism provided by the Odyssey board. This will require the development of suitable tools for processing speech signals.

3.8 Time-Oriented Problem Solving

The University of Rochester
Principal Investigator:
James Allen

In the past year significant progress has been made, both on the development of reasoning tools and on basic research issues concerning planning in temporal world models. In particular, the HORNE reasoning system was completed and made available to other research laboratories and universities: it has now been distributed to over fifty sites in North America. A model theory and axiomatization of a logic for reasoning about planning in domains where the planning agent may perform concurrent actions and may have to interact with events initiated by other agents and external forces was finalized. The most recent work has involved the development of a simple planning algorithm based on the above logic, and a rigorous proof that the algorithm corresponds to a valid proof in that logic has been completed. A thesis due for completion in Spring 1987 develops the first formal description of the plan recognition process. A Common Lisp implementation of one of the recognition algorithms was completed, and tested on plan recognition systems in a variety of domains.

For future plans, the successor to HORNE (RHET) is under development. This system will extend HORNE to include context, maintainability of code, negative assertions and proofs, an improved user interface, and improved lisp-oriented implementation. Also planned are the addition of a reason maintenance facility. A major focus of next year's research will be on the role of abstraction in planning formalisms. Plans are in place to extend work on formalizing abstraction in problem solving and planning tasks to a definition of abstraction in planning for STRIPS-type planners. Also under consideration are performance metrics with which one can analytically demonstrate under what conditions a particular strategy will result

in actual performance improvements.

3.9 Parallel, Structural, and Optimal Techniques in Vision

The University of Rochester
Principal Investigator:
Christopher Brown

Research under Dr. Brown's guidance has proceeded to investigate a variety of fundamental issues in the field of computer vision. The five principal areas being pursued are:

1) *Computer Vision and Structure:* The goal of this work is to do object recognition using structural (relational) information about the object rather than global properties such as shape. The work has taken three paths simultaneously:

a) development of prototype end-to-end system, experimentation with it, and reporting of this work;
b) work on stereo from structure
c) work on uncertainty in recognition from structure

2) *A Probabilistic Approach to Low-Level Vision:* Work has proceeded with a probabilistic approach to limited support boundary point detection. Algorithms developed here have been shown to the simple edge detectors of Sobel and Kirsch, and are planned to be tested against Nalwa's state-of-the-art edge detector. The detectors have been tested using a set of graphics programs developed, which generated images with shapes chosen at random with random intensities and positions. Programs were also developed to add noise of specified distribution mean and standard deviation to images. This image processing environment is available in the public domain.

3) *Information Fusion for Multi-Modal Segmentation:* This research addresses the problem of integrating the disparate sources of information available in low-level image computations to obtain scene properties of the image segments. Different characteristics of the available information have been identified, and proposals for integration tools to utilize them have been made. Preliminary experimental results, with synthetically generated images as input and a set of likelihood edge detectors to compute likelihood ratios, have shown several advantages of the approach used here. Using a fusion mechanism derived from the above work, a deterministic estimation procedure has been implemented which dynamically adjusts its estimations as new bodies arrive. Finally, a simulation package has been implemented to compare various estimation methods.

4) *Computer Vision on a Multiprocessor:* Efforts in this area can be divided into three areas: Utilities and Benchmarks, Concurrent Memory Allocation, and Computational Models of Human Motion Perception.

In the area of utilities and benchmarks, software architectures for combining the output of independent low-level vision processes on the BBN Butterfly Multiprocessor have been investigated, resulting in the implementation of a two-dimensional image segmentator as a vehicle for studying the issues involved. Parts of the IFF/UBX image processing package have been adapted for the Butterfly. Efforts divide into three subprojects:

a) porting the IFF bit-oriented file packing and unpacking library to the Butterfly environment
b) providing an appropriate replacement for UNIX's file system and pipes
c) rewriting existing IFF utilities to take advantage of the Butterfly's capabilities.

In terms of concurrent memory allocation, work is proceeding on concurrent versions of the well-known first-fit memory allocation algorithm. A number of algorithms have been designed that trade concurrency for overhead in a variety of fashions. These algorithms are being implemented on the Butterfly, with the intent of evaluating their performance under various simulated load conditions.

Finally, in regards to computational models of human motion perception, the architecture of the human motion processing system is being studied. This has led to some interesting conclusions, including the apparent discovery that the short-range process of human motion perception has a much greater range that was originally believed.

5) *Analyzing Massively Parallel Computation:* This work has pursued a connectionist model of computation, becoming widely known as "neural networks." The model that is often studied is that of an asynchronous symmetric network, where a global energy/goodness measure can be established, and is used to prove that the network totally stabilizes. This symmetry condition is somewhat unnatural for biological reasons, and moreover precludes many computations that are biologically important.

In this work, asymmetric networks are pursued, that might admit infinite activated computations. Within this framework, an operational semantics has been defined, and flow properties of some specific structured networks are formally analyzed, with respect to a given specification (or correctness criterion) that characterizes the dynamics of an oscillator. The question of whether an asymmetric stabilizes totally is therefore raised as a major specification, and research indicates that this is an NP-hard question, solvable in a polynomial space. This investigation is original in this context of neural networks, and motivates further research on other correctness

assertions within this model.

3.10 Planner System for the Application of Indicators and Warning

Colgate University
Principal Investigator:
Sergei Nirenburg

During this year, Dr. Nirenburg worked on the design and construction of the Lexicon Management System, an interactive, intelligent knowledge acquisition tool to support the acquisition of lexicons in natural language-related applications. The system design consisted of three modules:

1) a subsystem supporting the acquisition of concept lexicons, ontologies of application domain subworlds;
2) a subsystem supporting the acquisition of the lexicon, called analysis lexicon for the natural language which will eventually be used to supply input to the application system;
3) a subsystem supporting the acquisition of the lexicon for the generation stage of an NLP application. Even if the same natural language is used for input and output by an application, the dictionaries for analysis and generation will still have to be distinct.

Also developed during this period was a specialized editor on the TI Explorer for displaying and manipulating trees and networks. Design was completed and implementation begun on the lexicon enterer interface to the back-end processor, whose tasks included displaying error messages from failed tests as well as suggestions for the correction of those errors.

4. ANCILLARY GOALS OF THE CONSORTIUM

The ancillary goals of the Consortium are three-fold: to develop more artificial intelligence expertise at the university level; to encourage industrial support of and participation in the AI programs of the Consortium institutions and interaction with institutions outside the Consortium; and to develop active AI community support.

4.1 Develop More AI Expertise at the University Level

4.1.1 Faculty and graduate student growth

While difficult, systematic and aggressive efforts are being made at each of the member institutions to add new faculty members, post-doctoral students and US graduate students specializing in AI. Some progress has been made and, in part because of the Consortium, there is an increased awareness of an interest in AI research on the various campuses. This alone has resulted in an increase in the number of faculty and graduate students working on AI research.

All institutions report that they have increased the total number of graduate and post-doctoral (where applicable) students in their AI research programs, including an increase in the number of US students. Some of these are supported by funding other than this Consortium contract. To attract more US students, some of the institutions have indicated a willingness to grant exceptions to their rules regarding the maximum number of credits a student can transfer from one institution to another. Several Consortium institutions are working with various industries to secure increased funding for graduate fellowships.

In total, the Consortium members report an involvement of fourteen faculty and 58 graduate students.

As progress is made in other areas and the Consortium continues to be better known, the task of recruiting should become somewhat easier.

4.1.2 Facility improvement

Through the efforts of Clarkson University on behalf of the Consortium, the NAIC was awarded a $250,000 equipment grant under the DOD/URIP towards the purchase of LISP machines to be placed at each NAIC institution. After extensive discussions with potential vendors, the NAIC principal investigators voted to choose Texas Instruments to supply the LISP machines (Explorers). As a result of generous discounts from Texas Instruments and university contributions of $12,500 per Explorer, the NAIC acquired sixteen machines which were distributed as follows:

SUNY Buffalo.....Two
Clarkson.....Three
UMass Amherst.....Three
RIT.....Two
RPI.....Two
UofR.....Three
Syracuse University.....One

This distribution also reflects the stated needs and desires of the member institutions. Efforts to link all NAIC institutions with MILNET were also continued and many institutions had acquired the boards to be installed in their machines.

4.1.3 Seminars, course changes and additions

Hand in hand with increased faculty and improved facilities go course changes and additions and with course additions, come more students and again the need for more faculty and facilities. This process is well under way. All member universities have improved or expanded their AI course offerings. Graduate seminars on AI have become regularly scheduled functions on campuses where they had not previously existed and more frequent on those where they had been previously held. In addition, workshops and colloquia for individual institutions have featured experts from other Consortium institutions.

4.1.4 Interaction between members of the Consortium

Interaction between members of the Consortium has taken several forms. The principal addition to this effort was the creation of the Executive Committee, which brought together on a regular and frequent basis four representatives from the member institutions to act on emerging issues which did not require the full attention or discussion of all Consortium members. The first four members of the Executive Committee were:

SUNY/Buffalo.....(2-year term)
University of Massachusetts.....(2-year term)
University of Rochester.....(1-year term)
Rensselaer Polytechnic Institute.....(1-year term)

Efforts begun the previous year also continued, such as regular Consortium meetings, monthly reports, specific cross visits, and attendance at various national and international professional conferences. Details of these meetings will be covered in a later section.

The following meetings took place before the formal organization of the Consortium and were instrumental in the continued development of a sense of identity for the NAIC:

March 12-13, 1986	NAIC Spring Meeting, University of Massachusetts at Amherst
July 9-11, 1986	NAIC Annual Meeting, University of Rochester
September 25-26, 1986	NAIC Fall Meeting, SUNY/Buffalo

NAIC Spring Meeting

The NAIC Spring Meeting was held at the University of Massachusetts-Amherst on March 12 and 13, 1986. The topic of the meeting was "Plan Recognition." Several demonstrations were held at the Lederle Graduate Research Center. A copy of the agenda and a list of the attendees are provided at the end of this volume. A management meeting was held at this time, and the notes from this meeting may also be found at the end of this volume. The principal topics discussed were:

The creation of a single NAIC brochure, rather than multiple versions.
The initiation of the Educational Instrumentation Proposal.
Selection of students for the Sperry Fellowship.
Seminars at RADC
The location of the Sperry Explorer.

NAIC Annual Meeting

The NAIC Annual Meeting and Project Review was held at the University of Rochester, July 9-11, 1986. A copy of the meeting notes and list of attendees may be found at the end of this volume. The meeting was well attended and was judged to have been successful.

NAIC Fall Meeting

The NAIC Fall Meeting was held at SUNY/Buffalo, September 25-26, 1986. The meeting was co-hosted by Drs. Shapiro and Srihari, with assistance from Ms. Spahr and various staff and graduate students within the Computer Science Department. Approximately seventy persons attended this meeting. Eleven papers on the theme "Spatial Knowledge Representation and Reasoning" were presented.

4.2 Encourage Industrial Support and Participation and Interaction with Institutions Outside the Consortium

Efforts to encourage industrial support of and participation in the AI research at the various institutions have continued by both the Consortium's program manager and project director and the individual institutions. The Consortium has been well received and the individual institutions report that being a member of the Consortium has resulted in a growth of interest and opportunities for interaction with industry.

4.2.1 Industrial Advisory Board

During visits to various companies by the Project Director and/or the Program Manager to investigate the possibilities of industrial coupling, several individuals expressed an interest in serving on an industrial advisory board. The board was formally organized in June 1985, with twelve members, and held its first meeting at Syracuse University on June 26. The purpose is to seek the advice and counsel of the board in establishing interactions between industry and the Consortium in pursuing research, educational and facility development activities. Board members were invited to all three major meetings.

The industrial advisory board consists of the following members:

Dr. Larry Alexander..... .....General Electric Company
Mr. William Bennett.....SINGER Aerospace and Marine Systems
Dr. Gerard Capraro.....Kaman Sciences Corporation
Dr. James Cook.....IIT Research Institute
Dr. Patrick Corbin.....UNISYS
Mr. Eugene P. Damm, Jr.....IBM Corporation
Mr. George Hunt.....Xerox Corporation
Mr. Robert Kleeman.....Symbolics, Inc.
Dr. James Mosko.....ITT Defense Communications
Mr. Charles Saylor.....Niagara Mohawk Power Corporation
Dr. Dan Simmons.....United Technologies Company
Dr. Benjamin Snavely.....Eastman Kodak Company
Dr. Michael J. Zoracki.....New Hartford Technology Center (PAR Tech.)

4.2.2 National and International Professional Conferences and Publications

Consortium PI's deem attendance at national and international professional conferences to be of great importance for several reasons. First, the Consortium gains a higher degree of visibility by having several Consortium institutions present at such meetings. This is in addition to the growing respect afforded the Consortium by the presentation of papers and the chairing of sessions. Secondly, the meetings afford yet another opportunity for interaction between Consortium PI's which is most helpful.

During 1986, the Consortium accelerated its efforts at external contacts. A total of 21 visits to corporations were made, along with 22 visits to other academic institutions. Members attended or gave a total of 37 seminars and made 42 visits to government sites. Finally, in addition to regularly-scheduled Consortium meetings, six visits between members were made. Over a hundred papers were published, and numerous conferences were attended. The following is a partial list of the major conferences, attended by Consortium PI's as presenters and attendees, as mentioned in their monthly status reports (funding of attendance was not necessarily provided

by this contract):

The Second International Conference on Data Engineering
ACM Computer Science Conference
Conference on Theoretical Aspects of Reasoning about Knowledge
Applications of AI to Engineering Problems Conference
VI International Workshop on Expert Systems
IV Annual Conference on Intelligent Systems and Machines
Symposium on the Role of Language in Problem Solving
SPIE Artificial Intelligence Meeting
Speech Technology Conference
DARPA Planning Workshop
Canadian AI Conference
National Computer Conference
INSIGHT Workshop
Workshop on the Future of Expert Systems
Association for Computational Linguistics Annual Meeting
Third International Logic Programming Conference
Workshop on Database Machines
AAAI Annual Conference
XI International Conference on Computational Linguistics
ICCC 1986
Foundations of Computer Science Conference
SPSE Conference on Electronic Imaging
Third International ACM-SIGOIS Conference on Office Information Systems
Distributed AI Workshop
Expert Systems in Government
USPS Advanced Technology Conference
Conference on Advances in Lexicography

Numerous papers have also been submitted for publication and/or presentation at various conferences in the country and abroad.

SUNY Buffalo

"A Fault Diagnosis System Based on an Integrated Knowledge Base," paper by Stuart C. Shapiro, Sargur N. Srihari, James Geller, and Mingruey R. Taie.

"Diagnosis Based on Empirical and Model Knowledge," paper by Z. Xiang and S.N. Srihari.

"Computerized neurological diagnosis: a paradigm of modeling and reasoning," paper by Z. Xiang, J.G. Chutkow, S.C. Shapiro, and S.N. Srihari.

"Device representation using instantiating rules and structural templates," paper by M.R. Taie, S.N. Srihari, J. Geller, and S.C. Shapiro given at the Canadian AI Conference.

"Object recognition in structured and random environments," talk at SUNY College, Brockport, given at the Canadian AI Conference.

"VMES: a network-based versatile maintenance expert system," paper by S.C. Shapiro and S.N. Srihari.
"Applications of expert systems in engineering," paper by S.N. Srihari.
"Address block location: specialized tools and problem-solving architecture," by S.N. Srihari, JJ. Hull, P.W. Palumbo, and C.H. Wang. Presented by Srihari.
"Use of external information in zip-code recognition," by J.J. Hull and S.N. Srihari. Presented by Hull.
"Device modeling for fault diagnosis," by M.R. Taie and S.N. Srihari. Presented by Taie.
"Multi-level reasoning in fault diagnosis," by Z. Xiang and S.N. Srihari. Presented by Xiang.
"Rule-based document image understanding," by D. Niyogi and S.N. Srihari. Presented by Niyogi.
"Document image analysis," by S.N. Srihari and G.W. Zack. Presented by Srihari in Paris, France.
"Document image understanding," paper by S.N. Srihari.
"Text parsing using spatial information in recognizing addresses in mail pieces," by P.W. Palumbo and S.N. Srihari. Presented by Srihari in Paris, France.
"Use of global context in text recognition," by J.J. Hull. Presented by Srihari in Paris, France.
"LISP: An Interactive Approach," paper by Stuart C. Shapiro
"Theoretical foundations for belief revision," paper by J.P. Martins and S.C. Shapiro.
"Belief revision in SNePS," paper by J.P. Martins and S.C. Shapiro given at the Canadian AI conference.
"Theoretical foundations for belief revision," talk by S.C. Shapiro at Tektronix AI Labs, OR; and at UCLA.
"Hypothetical reasoning," paper by J.P. Martins and S.C. Shapiro.
"Semantic network-based reasoning systems," talk by S.C. Shapiro.
"SNePS considered as a fully intensional propositional semantic network," presentation by Stuart C. Shapiro and William J. Rapaport.
"Using belief revision to detect faults in circuits," presentation by Scott Campbell and Stuart Shapiro.

Clarkson University

"The role of knowledge-based systems in telecommunications network management," talk at Southampton University.
"Distributed artificial intelligence in communications systems," presentation by Susan Conry.
"SIMULACT: A generic tool for simulating distributed systems," presentation by Susan Conry and MacIntosh.
"GUS: A graphical interface for capturing structural knowledge," paper by Robert Meyer and B. Hogencamp.
"The role of knowledge-based systems in communications system control," abstract by Robert Meyer and Charles Meyer.
"Distributed planning," talk by Susan Conry.

"Multistage negotiation in distributed planning," paper by Susan Conry, Robert Meyer, and Victor Lesser.

Colgate University

"The subworld concept lexicon and the lexicon management system," by Sergei Nirenburg.

"Providing intelligent assistance in distributed office environments," presentation by Sergei Nirenburg.

"Linguistics and Natural Language," presentation by Sergei Nirenburg.

"The analysis lexicon and the lexicon management system," paper by Sergei Nirenburg and Victor Raskin.

University of Massachusetts - Amherst

"Planning Discourse in an Intelligent Tutor," talk given at Brown University.

"Theoretical Frontiers in Building a Machine Tutor," paper by Beverly Woolf.

"Matching for Knowledge Acquisition," paper by Larry Lefkowitz.

"A Representation for Collections of Temporal Intervals," paper by David Forster, Bruce Leban and David McDonald.

"Knowledge Acquisition for Knowledge-Based Systems Workshop," paper by Larry Lefkowitz.

"Design of the GRAPPLE plan recognition system," presentation by Beverly Woolf, Bruce Croft, Carol Broverman, and Karen Huff.

"Teaching a complex industrial process," paper by Beverly Woolf.

"Tutoring strategies for computer tutors which deal with misconceptions in Physics," paper by Tom Murray and Beverly Woolf.

"Discourse transition networks for intelligent tutoring systems," paper by Beverly Woolf and Tom Murray.

"Task management for an intelligent interface," paper by Bruce Croft and Steve Schwartz.

Rensselaer Polytechnic Institute

"Visibility based digital terrain models," presentation by G. Nagy in Seattle.

"Algorithms for manipulating nested block-represented images," presentation by J. Kanai, M.S. Krishnamoorthy, and T. Spencer.

"A rule-based expert system approach for high-quality image enhancement," presentation by J.S.P. Shu.

"Removal of cloud shadows from aerial photograph," presentation by H. Freeman and J.S.P. Shu.

"Document analysis using X-Y tree and rule-based system," paper by J. Yu.

"Visibility in two and a half dimensions," paper by D.L. Allen.

University of Rochester

"A model of planning based on counterfactuals," talk at SRI Intl. and at Yale University.

"The relation between plan recognition and planning," talk given at Stanford University.
"Planning in temporally rich domains," presentation at AT&T Bell Labs, NJ.
"A formal theory of plan recognition," talk at University of Massachusetts.
"A formal logic of plans in temporally rich domains," paper by R. Pelavin and J.F. Allen.
"Generalized plan recognition," paper by H.A. Kautz and J.F. Allen.
"Maintaining Knowledge about Temporal Intervals," presentation in Abbey, Scotland.
"Representation problems facing planners in realistic domains," presentation at Edinburgh, Scotland.
"A logic of plans in temporally rich domains," presentation given at University of Edinburgh.
"The logic of persistence," presentation by H.A. Kautz.
"Planning with abstraction," presentation by J. Tenenberg.
"Constraint propagation algorithms for temporal reasoning," presentation by M. Vilain and H.A. Kautz.
"Fairness in models for nondeterministic computations," presentation by S. Porat.

Syracuse University
"Interfacing Prolog with a Relational Database System," paper by Keith Hughes.
"Optical techniques in knowledge and data bases: overview and future research directions," presentation by N. Troullinos and P. Bruce Berra.
"The evaluation of superimposed code words, concatenated code words and tnd transformed inverted lists in the context of partial match retrieval," presentation by P. Bruce Berra, S. Chung, N. Hachem, and M. Kim.
"Some thoughts on an optical data/knowledge base machine," presentation by P. Bruce Berra and N. Troullinos.
"Computer architecture for the processing of a surrogate file to a very large data/knowledge base," paper by P. Bruce Berra.
"Computer architecture for data and knowledge bases in the context of logic programming," presented by P. Bruce Berra in Beijing, China.
"The design and implementation of a high-speed portable Prolog compiler," paper by Bowen, Buettner, Cicekli, and Turk.

4.3 Develop Active AI Community Support

The goal of developing active community support was pursued in conjunction with the other goals of the Consortium, especially that of encouraging industrial support and participation. One aspect was the enhancement of the Consortium's image. The other was to provide a service, such as courses in AI, that might lead to the awarding of an advanced degree.

4.3.1 Enhance the Consortium's Image

Each visit to an industry, every paper presented at a conference helped to make the Consortium more visible. Press releases to newspapers, professional society publications, various newsletters and alumni magazines, and radio and TV interviews have also enhanced the Consortium's image.

The flyer describing the research activities of each member institutions was revised and re-issued. This will aid in the recruitment efforts of each institution as well as provide publicity for the Consortium.

4.3.2 Public service

Courses for personnel at RADC and local industry continue to be given at the Syracuse University Graduate Center at Rome, NY. A course given in the spring of 1986 generated enough interest that it was necessary to provide two sections.

Northeast Artificial Intelligence Consortium

1986 Spring Meeting

March 12 -13, 1986

University of Massachusetts - Amherst

Agenda

1986 Northeast AI Consortium
Spring Meeting

March 12 - 13, 1986

Tentative Program Outline

Wednesday, March 12

7:00 p.m. Cocktail Hour (cash bar)
Rooms 1001-02, 10th floor, Lincoln Campus Center

8:00 p.m. Dinner at the Top of the Campus Restaurant
(From regular menu; individual receipts will be provided)
11th floor, Lincoln Campus Center

9:30 p.m. Meeting of the Northeast AIC Principal Investigators
Room 901, 9th floor, Lincoln Campus Center

Thursday, March 13

9:00 Talk Bev Woolf, University of Massachusetts

"Intelligent Interfaces Project at the University of Massachusetts"

9:20 Talk Sergei Nirenburg, Colgate University

"Providing Intelligent Assistance in Distributed Office Environments"

9:45 Talk Daniel Corkill, University of Massachusetts

"Planning and Distributed Problem Solving"

10:10 10-minute Coffee Break

10:20 Talk James Allen, University of Rochester

"A Semantics for Planning in Temporally Rich Domains"

10:45 Talk Norm Carver, University of Massachusetts

"Plan Recognition Using a Semantic Database and First Principles Knowledge in POISE"

11:10 Talk Henry Kautz, University of Rochester

"A Logical Theory of Plan Recognition"

11:35 Talk Paul Cohen, University of Massachusetts

"Uncertainty in Plan Recognition"

12:00 Buffet Lunch (1 1/2 hours), Room 1101

1:25 Leave for Lederle Graduate Research Center for Demos.

1:30 POISE demo, with Larry Lefkowitz and Norm Carver Wombat Lab, Room A262, LGRC (20 minutes)

1:50 MUMBLE demo, followed by CICERO demo, with Marie Vaughan and Sabine Bergler, room A-205A, LGRC (1/2 hr.)

2:00 Robotics demo, with Gerry Pocock, Rooms 202/208 (1/2 hr.)

2:30 Demo of Thinkertoy: An Environment for Decision Support, with Steve Gutfreund, room A-310B

2:50 Return to Campus Center conference room

3:00 Talk Robert Meyer, Susan Conry, Janice Serleman Clarkson University

"Planning as a Distributed Constraint Satisfaction Problem"

3:25 5-minute Coffee Break

3:30 Talk Larry Lefkowitz, University of Massachusetts

"Knowledge Acquisition and Plan Recognition"

3:55 Talk Bruce Leban, University of Massachusetts

"Towards a Representation for Collections of Temporal Intervals"

4:20 Talk Ed Durfee, University of Massachusetts

"Planning for Cooperation in a Distributed Problem-Solving Network"

4:40 Talk David McDonald, University of Massachusetts

"Planning in the Control of Discourse--a New Architecture"

* ** * ** * ** * ** * ** * **

Northeast Artificial Intelligence Consortium

1986 Summer Meeting

July 9 - 11, 1986

University of Rochester

Agenda

Northeast Artificial Intelligence Consortium

Gowen Room, Wilson Commons (2nd Floor)

University of Rochester, Rochester, New York

July 9-11, 1986

Wed., 7/9	11:00 -	Registration
	12:00 - 2:00	Presentation to PIs by SUN Microsystems
	2:00 - 3:30	General Meeting of Consortium PIs
	3:30 - 4:00	Coffee Break
	4:00 - 5:00	General Meeting (Continued)
	5:30 & 6:30	Reception and Dinner (May Room, 4th Fl.)
Thurs., 7/10	7:30 -	Breakfast Ticket for Common Ground Cafe (1st Fl.)
	8:30 - 9:30	Education Committee Meeting
	9:30 - 10:30	Industrial Advisory Board Meeting / Coffee Break
	10:30 - 10:45	Opening Remarks: Dr. Fred I. Diamond, RADC
	10:45 - 11:00	Program Overview: Lt. Col. Robert Simpson, DARPA
	11:00 - 11:30	Technical Presentation(s): Syracuse University
	11:30 - 12:15	Technical Presentation(s): SUNY at Buffalo
	12:15 - 1:15	Lunch (Bridge Lounge, 4th Floor)
	1:15 - 2:15	Technical Presentation(s): University of Massachusetts
	2:15 - 3:00	Technical Presentation(s): Rochester Inst. of Technology
	3:00 - 3:20	Coffee Break
	3:20 - 3:55	Technical Presentation(s): Colgate University
	3:55 - 4:30	Technical Presentation(s): Renssalaer Polytechnic Inst.
	4:30 - 6:00	Roundtable Discussion: PIs and RADC
	6:15	Bus leaves for Hong Kong Restaurant (from behind Rush Rhees Library)
Fri., 7/11	7:30 -	Breakfast Ticket for Common Ground Cafe (1st Fl.)
	8:45 - 9:00	Dr. Lawrence Porter, AF WAL
	9:00 - 9:15	Program Overview: Dr. Northrup Fowler III, RADC
	9:15 - 9:30	Program Overview: Capt. Kevin B. Kline, AF HRL
	9:30 - 10:15	Technical Presentation(s): Clarkson University
	10:15 - 10:30	Coffee Break
	10:30 - 11:15	Technical Presentation(s): University of Rochester
	11:15 - 12:00	Workshop Wrap Up and Discussion
	12:00 - 1:30	Demonstrations in Computer Science Department

Northeast Artificial Intelligence Consortium

1986 Fall Meeting

September 25-26, 1987

SUNY Buffalo

Agenda

NORTHEAST ARTIFICIAL INTELLIGENCE CONSORTIUM
FALL 1986 CONFERENCE

State University of New York at Buffalo
Center for Tomorrow

September 26, 1986

Spatial Knowledge Representation and Reasoning

PROGRAM

Registration

8:00

Theme Definition and Program Overview

8:30 Sargur Srihari, SUNY at Buffalo
Spatial Knowledge Representation and Reasoning

Spatial Reasoning

8:55 Beverly Woolf, University of Massachusetts
The Role of Spatial Reasoning in Intelligence

9:20 Hanyong Yuhan, SUNY at Buffalo
Resolution of the Spatial Reference Frame Problem in Narrative Understanding

9:45 Leo Hartman, University of Rochester
On the Practical Solution of Geometric Problems

Coffee Break

10:10-10:40

Maintenance, Diagnosis, and Qualitative Reasoning

10:40 James Geller, SUNY at Buffalo
Representation of Spatial Knowledge for the Maintenance Domain

11:05 Zhigang Xiang, SUNY at Buffalo
Multi-Level Model-Based Diagnostic Reasoning

11:30 Shoshana Hardt, SUNY at Buffalo
Qualitative Reasoning About the Effects of Channel Geometry on Flow Rates

Lunch at Center for Tomorrow

12:00-1:00

Computer Science Open House, Bell Hall, 2nd Floor

1:00-2:30

Vision

2:30 Michael Leyton, SUNY at Buffalo
Process Inferring Symmetry Analysis

2:55 Ching-Huei Wang, SUNY at Buffalo

Coffee Break

3:20-3:40

Object Recognition in Structured and Random Environments: Locating Address Blocks on Mail Pieces

3:40 Debashish Niyogi, SUNY at Buffalo
Document Understanding Using a Knowledge-Based Methodology

4:05 Deb Walters, SUNY at Buffalo
General-Purpose Computer Vision Algorithms Based on Image Invariants

End of Conference

4:30

END

DATE

FILMED

DTIC

10-88