VISION

EARLY VISION PROCESSING

A Statistical Technique for Recovering Surface Orientation from Texture in Natural Imagery
Andrew P. Witkin ........................ 1

Mapping Image Properties into Shape Constraints: Skewed Symmetry and Affine-Transformable Patterns, and the Shape-from-Texture Paradigm
John R. Kender and Takeo Kanade ........ 4

What Should Be Computed in Low Level Vision Systems
William B. Thompson and Albert Yonas ... 7

Interpreting Line Drawings as Three-Dimensional Surfaces
Harry G. Barrow and Jay M. Tenenbaum ... 11

Shape Encoding and Subjective Contours
Mike Brady, W. E. L. Grimson and D. J. Langridge ....... 15

SCENE ANALYSIS

Information Needed to Label a Scene
Eugene C. Freuder .................................. 18

Interpretive Vision and Restriction Graphs
Rodney A. Brooks and Thomas O. Binford .... 21

Sticks, Plates, and Blobs: A Three-Dimensional Object Representation for Scene Analysis
Linda G. Shapiro, John D. Moriarty, Prasanna G. Mulgaonkar and Robert M. Haralick ......... 28

MOTION ANALYSIS

Constraint-Based Inference from Image Motion
Daryl T. Lawton .................................. 31

Static Analysis of Moving Jointed Objects
Jon A. Webb ..................................... 35

Bootstrap Stereo
Marsha J. Hannah .................................. 38

ROBOTIC VISION

Locating Partially Visible Objects:
The Local Feature Focus Method
Robert C. Bolles .................................. 41

Interference Detection and Collision Avoidance Among Three Dimensional Objects
N. Ahuja, R. T. Chien, R. Yen and N. Bridwell ........ 44
Automated Inspection Using Gray-Scale Statistics  
Stephen T. Barnard ........................................ 49

Publication Only

Human Movement Understanding: A Variety of Perspectives  
Norman I. Badler, Joseph O'Rourke, Stephen Platt and Mary A. Morris ........... 53

An Optimization Approach for Using Contextual Information in Computer Vision  
Olivier D. Faugeras ......................................... 56

PROGRAM SYNTHESIS

Question Ordering in a Mixed Initiative Program Specification Dialogue  
Louis Steinberg ............................................... 61

Some Algorithm Design Methods  
Steve Tappel .................................................. 64

Automatic Goal-Directed Program Transformation  
Stephen Fickas ................................................ 68

Publication Only

Incremental, Informal Program Acquisition  
Brian P. McCune ............................................. 71

A Basis for a Theory of Program Synthesis  
P. A. Subrahmanyam ........................................... 74

A Program Model and Knowledge Base for Computer Aided Program Synthesis  
Richard J. Wood ............................................. 77

THEOREM PROVING

An Efficient Relevance Criterion for Mechanical Theorem Proving  
David A. Plaisted ............................................. 79

On Proving Laws of the Algebra of FP-Systems in Edinburgh LCF  
Jacek Leszczyłowski .......................................... 84

A Technique for Establishing Completeness Results in Theorem Proving with Equality  
Gerald E. Peterson ........................................... 87
**Automatic Generation of Semantic Attachments in FOL**  
Luigia Aiello ........................................ 90

**HCPRVR: An Interpreter for Logic Programs**  
Daniel L. Chester ..................................... 93

**First Experiments with Rue Automated Deduction**  
Vincent J. Digricoli .................................. 96

**MATHEMATICAL AND THEORETICAL FOUNDATIONS**

What's Wrong with Non-Monotonic Logic?  
David J. Israel ........................................ 99

Pathology on Game Trees: A Summary of Results  
Dana S. Nau ........................................... 102

Max-Min Chaining of Weighted Causal Assertions is Loop Free  
S. W. Ng and Adrian Walker .......................... 105

**PROBLEM SOLVING**

**COORDINATING EXPERT SYSTEMS**

Robert Balzer, Lee Erman, Philip London, and Chuck Williams ............ 108

Quantifying and Simulating the Behavior of Knowledge-Based Interpretation Systems  
V. R. Lesser, S. Reed, and J. Pavlin ........................ 111

Representation of Task-Specific Knowledge in a Gracefully Interacting User Interface  
Eugene Ball and Phil Hayes .............................. 116

**PROBLEM SOLVING AND CONTROL**

Representation of Control Knowledge in Expert Systems  
Janice S. Aikins ....................................... 121

DELTA-MIN: A Search-Control Method for Information-Gathering Problems  
Jaime G. Carbonell .................................... 124

On Waiting  
Arthur M. Farley ...................................... 128

A Planner for Reasoning about Knowledge and Action  
Douglas E. Appelt ..................................... 131
<table>
<thead>
<tr>
<th>Title</th>
<th>Author(s)</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Making Judgments</td>
<td>Hans J. Berliner</td>
<td>134</td>
</tr>
<tr>
<td>Multiple-Agent Planning Systems</td>
<td>Kurt Konolige and Nils J. Nilsson</td>
<td>138</td>
</tr>
<tr>
<td>SCOUT: A Simple Game-Searching Algorithm with Proven Optimal Properties</td>
<td>Judea Pearl</td>
<td>143</td>
</tr>
<tr>
<td>Problem Solving in Frame-Structured Systems Using Interactive Dialog</td>
<td>Harry C. Reinstein</td>
<td>146</td>
</tr>
<tr>
<td>Representing Knowledge in an Interactive Planner</td>
<td>Ann E. Robinson and David E. Wilkins</td>
<td>148</td>
</tr>
<tr>
<td>Inference with Recursive Rules</td>
<td>Stuart C. Shapiro and Donald P. McKay</td>
<td>151</td>
</tr>
</tbody>
</table>

**KNOWLEDGE REPRESENTATION**

<table>
<thead>
<tr>
<th>Title</th>
<th>Author(s)</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Frame-Based Production System Architecture</td>
<td>David E. Smith and Jan E. Clayton</td>
<td>154</td>
</tr>
<tr>
<td>Knowledge Embedding in the Description System Omega</td>
<td>Carl Hewitt, G. Attardi, and M. Simi</td>
<td>157</td>
</tr>
<tr>
<td>A Representation Language Language</td>
<td>Russell Greiner and Douglas B. Lenat</td>
<td>165</td>
</tr>
</tbody>
</table>

**APPLIED KNOWLEDGE REPRESENTATION**

<table>
<thead>
<tr>
<th>Title</th>
<th>Author(s)</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spatial and Qualitative Aspects of Reasoning about Motion</td>
<td>Kenneth D. Forbus</td>
<td>170</td>
</tr>
<tr>
<td>Computer Interpretation of Human Stick Figures</td>
<td>Martin Herman</td>
<td>174</td>
</tr>
<tr>
<td>Research on Expert Problem Solving in Physics</td>
<td>Gordon S. Novak and Agustin A. Araya</td>
<td>178</td>
</tr>
<tr>
<td>Knowledge-Based Simulation</td>
<td>Philip Klahr and William S. Faught</td>
<td>181</td>
</tr>
<tr>
<td>Interactive Frame Instantiation</td>
<td>Carl Engelman, Ethan A. Scarl and Charles H. Berg</td>
<td>184</td>
</tr>
</tbody>
</table>

**SPECIALIZED ISSUES IN KNOWLEDGE REPRESENTATION**

<table>
<thead>
<tr>
<th>Title</th>
<th>Author(s)</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptions for a Programming Environment</td>
<td>Ira P. Goldstein and Daniel G. Bobrow</td>
<td>187</td>
</tr>
<tr>
<td>Rule-Based Inference in Large Knowledge Bases</td>
<td>William Mark</td>
<td>190</td>
</tr>
<tr>
<td>A Process for Evaluating Tree-Consistency</td>
<td>John L. Goodson</td>
<td>195</td>
</tr>
</tbody>
</table>
Reasoning about Change in Knowledgeable Office Systems
Gerald R. Barber .......................... 199

On Supporting the Use of Procedures in Office Work
Richard E. Fikes and D. A. Henderson, Jr. .......... 202

Metaphors and Models
Michael R. Genesereth .......................... 208

Everything You Always Wanted to Know About Authority Structures But Were Unable to Represent
James R. Meehan .................................. 212

Real Time Causal Monitors for Complex Physical Sites
Chuck Rieger and Craig Stanfill ................. 215

KNOWLEDGE ACQUISITION

Applying General Induction Methods to the Card Game Eleusis
Thomas G. Dietterich .......................... 218

Modelling Student Acquisition of Problem-Solving Skills
Robert Smith ................................... 221

A Computer Model of Child Language Learning
Mallory Selfridge ............................... 224

Approaches to Knowledge Acquisition:
The Instructable Production System Project
Michael D. Rychener ............................ 228

Using a Matcher to Make an Expert Consultation System Behave Intelligently
Rene' Reboh .................................... 231

An Approach to Acquiring and Applying Knowledge
Norman Haas and Gary G. Hendrix ............... 235

Self-Correcting Generalization
Stephen B. Whitehill .......................... 240

SPECIALIZED SYSTEMS

Intelligent Retrieval Planning
Jonathan J. King .............................. 243

A Theory of Metric Spatial Inference
Drew McDermott ................................. 246

Design Sketch for a Million-Element NETL Machine
Scott E. Fahlman ................................. 249
Perceptual Reasoning in a Hostile Environment
Thomas D. Garvey and Martin A. Fischler . . 253

Overview of an Example Generation System
Edwina L. Rissland and Elliot M. Soloway . . 256

Publication Only

Structure Comparison and Semantic Interpretation of Differences
Wellington Yu Chiu . . . . . . . . 259

Performing Inferences over Recursive Data Bases
Shamim A. Naqvi and Lawrence J. Henschen . . 263

Piaget and Artificial Intelligence
Jarrett Rosenberg . . . . . . . . 266

APPLICATIONS

Rl: an Expert in the Computer Systems Domain
John McDermott . . . . . . . . 269

Rule-Based Models of Legal Expertise
D. A. Waterman and Mark Peterson . . . 272

Exploiting a Domain Model in an Expert Spectral Analysis Program
David R. Barstow . . . . . . . . 276

Project EPISTLE: A System for the Automatic Analysis of Business Correspondence
Lance A. Miller. . . . . . . . . 280

A Knowledge Based Design System for Digital Electronics
Milton R. Grinberg . . . . . . . . 283

Theory Directed Reading Diagnosis Research Using Computer Simulation
Christian C. Wagner and John F. Vinstonhaler . . . . . . . . 286

Publication Only

A Word-Finding Algorithm with a Dynamic Lexical-Semantic Memory for Patients with Anomia Using a Speech Prosthesis Kenneth Mark Colby, Daniel Christinaz, Santiago Graham, and Roger C. Parkison . . 289

Trouble-Shooting by Plausible Inference
Leonard Friedman . . . . . . . . 292

An Application of the Prospector System to DOE's National Uranium Resource Evaluation John Gaschnig. . . . . . . . . 295

Some Requirements for a Computer-Based Legal Consultant
L. Thorne McCarty . . . . . . . . 298
When Expectation Fails: Towards a Self-Correcting Inference System
R. H. Granger, Jr. ........................................ 301

Generating Relevant Explanations: Natural Language Responses to Questions about Database Structure
Kathleen R. McKeown .................................... 306

The Semantic Interpretation of Nominal Compounds
Timothy W. Finin ........................................ 310

Publication Only
Towards an AI Model of Argumentation
Lawrence Birnbaum, Margot Flowers, and Rod McGuire ........................................ 313

Knowledge Representation for Syntactic/Semantic Processing
Robert J. Bobrow and Bonnie L. Webber ................ 316

Language and Memory: Generalization as a Part of Understanding
Michael Lebowitz ......................................... 324

Failures in Natural Language Systems: Applications to Data Base Query Systems
Eric Mays .................................................. 327

MEMORY MODELS

Organizing Memory and Keeping it Organized
Janet L. Kolodner .......................................... 331

Meta-Planning
Robert Wilensky .......................................... 334

Narrative Text Summarization
Wendy G. Lehnert ........................................ 337