

ABSTRACTS OF CURRENT LITERATURE

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NEW REPORTS AND MEMOS

Report No. 5

**Entwurf eines aktiven, wissensbasierten
Hilfesystems fuer SINIX.**

Kemke, C.

Abridged version in *LDV-Forum. No. 2,*
December 1985, pp. 43-60.

The SC (SINIX Consultant) system is a natural language help facility for the SINIX operating system. SC should answer natural language questions about concepts and commands of the SINIX system. Furthermore, it should, as an active help system, give unsolicited advice to a user during his work with SINIX. In this paper, a short introduction to intelligent help systems is given, followed by an overview of the help systems UC, UCC, and WIZARD, the domain of which are the operating systems UNIX and VMS, respectively. In the next sections the basic structure and function of the SC is explained with special regard to the aspects of planning/problem-solving and knowledge representation.

Report No. 6

**The Role of Natural Language in
Advanced Knowledge-Based Systems**

Wahlster, W.

In Winter, H. (Hrsg.): *Artificial
Intelligence and Man-Machine Systems.*
Heidelberg: Springer 1986, pp. 62-83.

Natural language processing is a prerequisite for advanced knowledge-based systems since the ability to acquire, retrieve, exploit, and present knowledge critically depends on natural language comprehension and production. Natural language concepts guide the interpretation of what we see, hear, read or experience with other senses. In the first part of the paper, we illustrate the needed capabilities of cooperative dialog systems with a detailed example: the interaction between a customer and a clerk at an information desk in a train station. It is shown that natural language systems cannot just rely on knowledge about syntactical and semantical aspects of language but also have to exploit conceptual and inferential knowledge, and a user model. In the remainder, we analyze and evaluate three natural language systems which were introduced to the commercial market in 1985: Language Craft™ by Carnegie Group Inc.; NLMenu by Texas Instruments Inc.; and Q & A™ by Symantec Inc. The detailed examination of these systems shows their capabilities and limitations. We conclude that the technology for limited natural-language access systems is available now, but in foreseeable future the capabilities of such systems in no way match human performance in face-to-face communication.

Report No. 7**Combining Deictic Gestures and Natural Language for Referent Identification**

Kobsa, A.; Allgayer, J.; Reddig-Siekmann, C.; Reithinger, N.; Schmauks, D.; Harbusch, K.; Wahlster, W.

In *COLING '86. 11th International Conference on Computational Linguistics. Proceedings*. Bonn 1986, pp. 356-361.

In virtually all current NL dialog systems, users can refer to objects by linguistic descriptions only. In human face-to-face conversation, however, participants also frequently use various sorts of deictic gestures. In this paper, we present the referent identification component of XTRA, a natural language access system for expert systems. XTRA allows the user to combine NL input with pointing gestures on the terminal screen for referring to objects on the display. Information about the location and the type of this deictic gesture, as well as about the linguistic description of the referred object, the case frame and the dialog memory are utilized for identifying the object. The system is tolerant in respect to impreciseness of both the deictic and the natural language input. The user can thereby refer to objects more easily, avoid referential failures, and employ vague everyday terms instead of precise technical notions.

Report No. 8**Eine Graphikkomponente zur Integration von Zeigehandlungen in natuerlichsprachliche KI-Systeme.**

Allgayer, J.

In *GI-16. Jahrestagung. Proceedings, Vol. 1*. Berlin 1986, pp. 284-298.

In combining natural language and deictic gestures, a communicative, more adequate environment is generated, which, in many areas, allows AI-systems to become more widely accepted. As part of a natural language interface to expert systems, the procedure described here supports the construction of an environment in which language and language-supportive pointing methods are combined and processed in a context-sensitive manner. Within the visual field reproduced on the screen, a pointing gesture that best suits the desired expression can be chosen out of a particular defined spectrum. In many cases, it is only the combination of information obtained from both language and gesture analysis that allows for the extraction of the object intended by the user. There does not exist any one-to-one-mapping between the position of the gestures shown on the screen and the displayed objects.

Report No. 9**Coping with the Intrinsic and Deictic Uses of Spatial Prepositions**

Andre, E.; Herzog, G. and Rist, T.

In Jorrand, Ph. and Sgurev, V., (eds.): *Artificial Intelligence II. Proceedings of AIMS-86*. Amsterdam: North-Holland 1987, pp. 375-382.

This paper deals with the definition of a computational semantics for spatial relations between objects in a scene. In particular we examine the effects of the observer's position on the computation of spatial relations, the use of path prepositions, and degrees of applicability for spatial relations. Representational prerequisites and the computational analysis of spatial relations are investigated in the German dialogue system CITYTOUR.

Report No. 10**Form und Funktion von Zeigegesten, Ein interdisziplinärer Ueberblick**

Schmauks, D.

Even though pointing gestures represent a field of interest for many disciplines, they have not as yet been more thoroughly examined. In theory, their underlying principles pertain to artificial intelligence as well, since recently, pointing gestures can be simulated in certain areas of discourse. The following will deal with pointing gestures and their interaction with language under various differing circumstances. Chapter 2 lists a number of prerequisites for the use of pointing gestures. Then, in chapter 3 (semiotics) and chapter 4 (psychology), pointing gestures are considered as signs and means of non-verbal communication. In chapter 5, diverse functions of gestures with regard to language are differentiated, and syntactic insertion of obligatory pointing gestures is discussed. Some parameters for the classification of pointing gestures are found in chapter 6. Then, in chapter 7, the thesis is proven that combination of pointing gestures and verbal descriptions is not only efficient

Report No. 11
The SINIX-Consultant—Requirements, Design and Implementation of an Intelligent Help System for a UNIX Derivative

Kemke, C.

To appear in *User Interfaces*.

Proceedings of the International Conference of the Gottlieb Duttweiler Institut. Rueschlikon/Zuerich 1986.

but also sometimes necessary. Finally, in the last two chapters, a few remaining problems and possible solutions are dealt with.

The purpose of this paper is to describe the development of a project relating to the area of artificial intelligence, namely the SINIX Consultant SC, an intelligent help system for the SINIX operating system. SC should, on the one hand, answer natural language questions about concepts and commands of the SINIX system. On the other hand, it should, as an active help system, give unsolicited advice to a user during his work with SINIX, observing the user and giving hints to more efficient command sequences. So SC represents a help system which combines a passive and an active mode in order to aid the user. To fulfill these tasks, SC has to go beyond typical natural language system capabilities, by also providing tutoring and dialog maintenance capabilities, a model of the user's knowledge, and a recognition of his actual plans and goals. Besides this, a detailed model of the SINIX domain is necessary in order to perform the required problem solving and explanation tasks for generating adequate advice and answers.

Report No. 12
Processing Descriptions Containing Words and Gestures

Allgayer, J. and Reddig, C.

In Rollinger, C.-R. and Horn, W. (eds.): *GWAI-86 und 2. Oesterreichische Artificial-Intelligence-Tagung. Proceedings*. Berlin/Heidelberg: Springer 1986, pp. 119-130.

In person-to-person dialog, a lot of pointing gestures are used in order to facilitate and speed up the interaction. Our aim is to integrate this combination of natural language and deixis into man-machine communication. Since the analysis of pointing gestures is highly interwoven with the analysis of noun phrases, a system has been developed which accepts pointing gestures—which are simulated by means of a mouse click on a Lisp Machine screen—as part of a noun phrase in NL sentences. The syntactically and morphologically processed input sentence is represented as a functional-semantic structure by the intrasentential analysis. Aided by specific translation rules, the referential-semantic interpretation evaluates this structure with respect to three types of knowledge: the region currently pointed at on the screen, the relation to the dialog memory, and the associated individualized part of the conceptual knowledge base. This referent-identification process results in determining the intended referential object.

Report No. 13
Generating Referring Expressions and Pointing Gestures

Reithinger, N.

In Kempen, G. (ed.): *Natural Language Generation*. Dordrecht: Nijhoff 1987, pp. 71-81.

Among other things, a natural language generator, which is embedded in a dialog system, should take the user's input into account. In this way, the output generated will be better adapted to the user's needs. Consequently, the generator and the other components of the system should share knowledge bases whenever possible. In this paper, preliminary considerations pertaining to the generation component of XTRA—a natural language access system to expert systems—are presented. The generator is fully integrated into the system and shares its knowledge bases. The advantage of this structure is demonstrated for the generation of certain referring expressions. Apart from linguistic reference, e.g., pro-words, extralinguistic pointing gestures can be employed both by the user and the XTRA system as well. Finally, the integration of pointing gestures in the generation component is demonstrated.

Report No. 14
LEGAS—Inductive Learning of Grammatical Structures

Jansen-Winkeln, R.M.

This paper describes the theoretical approach to acquiring simple grammar rules from examples and its realization in a program called LEGAS (LEarning GrAMmatical Structures). The resulting rule set is developed incrementally through gradual

In Hallam, J. and C. Mellish (eds.):
Advances in Artificial Intelligence.
Proceedings of the AISB Conference.
Chichester: Wiley 1987, pp. 169–181.

Report No. 15
RMSAI—Ein Reason Maintenance
System Fuer approximative Inferenzen
Werner, M.

generalization and specialization. After each learning cycle, the rule set achieves a status called “complete” and “consistent” which guides the flow of control.

This paper presents a possible working solution to how a reason maintenance system is able to maintain the consistency of a set of premises and rules in a framework with approximative inferences and multiple deductions. In doing so, a dependency net which represents all known information about assertions and their dependencies (justifications) is defined and a maintenance algorithm which propagates all changes of nodes of the net to all affected successors is presented. Finally, a concept of consistency for a dependency net with nodes provided with an evidence value is defined, and it is pointed out how inconsistencies within a dependency net can be solved.

Report No. 16
Natural and Simulated Pointing—An
Interdisciplinary Survey
Schmauks, D.
In *Proceedings of the 3rd European ACL*
Conference. Copenhagen, Denmark 1986,
pp. 179–185.

Referent identification in human conversation is performed both by describing the objects in question and by pointing at them. Up until now, only the linguistic component could be simulated in dialog systems. But recently, technical innovations have made it possible to “point” at the objects on a display as well. The paper has two intentions. First, it investigates natural pointing in more detail and offers some possibilities to classify the great variety of pointing actions. Then it tries to clarify the extent to which pointing by technical means (especially mouse-clicks) can be regarded as a simulation of natural pointing (or as a functional equivalent). Furthermore, some steps towards even more accurate simulation are briefly mentioned.

Report No. 17
From Image Sequences to Natural
Language: Descriptions of Moving
Objects
Zimmerman, G.; Sung, K.; Bosch, G. and
Schirra J.R.J.

We present our work concerning the connection of a vision system to a natural language system. That is, automatic processing transforms the original sequence of TV images into natural language descriptions concerning moving objects. It is the first time that this transformation is achieved totally by computer. A vision system which has been developed in Karlsruhe is introduced in section 2. By means of analyzing displacement vector fields, trajectories of object candidates are recognized. In section 3, the natural language system CITYTOUR is briefly presented. The verbalization of spatial relations between static and moving objects can be studied with this system. Section 4 deals with the present state of the connection. The resulting data of the vision system are partially used and verbalized by CITYTOUR.

Report No. 18
Generierung natuerlichsprachlicher
Aeuerungen zur simultanen
Beschreibung von zeitveraenderlichen
Szenen
Andre, E.; Rist, T. and Herzog, G.
In Morik, K. (ed.): *GWAI-87. 11th*
German Workshop on Artificial
Intelligence. Proceedings. Berlin/
Heidelberg: Springer 1987, pp. 330–338.

Automatic generation of simultaneous descriptions for time-varying scenes reveals a problem which has not been dealt with within generation systems up to the present. As a scene is not described a posteriori, but instead simultaneously as the scene progresses, the entire scene itself would only then be known after its completion. For the coordination of perception and speech production, temporal aspects such as the time required for text generation and decoding time of the listener or reader have to be considered. The following paper examines the consequences arising out of this situation of simultaneous scene description with respect to the questions of “what to say” and “how to say”. Interaction between event-recognition and speech production in our system SOCCER will be illustrated by means of two example scenes.

Report No. 19
Ereignismodellierung zur
inkrementellen High-level
Bildfolgenanalyse

Rist, T.; Herzog, G. and Andre, E.

In Buchberger, E. and Retti, J. (eds.):
 3. *Oesterreichisch Artificial-Intelligence-*
Tagung. Proceedings. Berlin/Heidelberg:
 Springer 1987, pp. 1-11.

This paper deals with the problem of incrementally recognizing events in time-varying scenes. In order to allow for the application of an incremental recognition strategy, the prototypical occurrence of an event is described by means of a course diagram. Starting from a discrete time-model, special predicates are defined which, within a formal temporal logic, can be used to represent even events directly taking place. On the one hand, these predicates can be used within event models in order to define more complex course diagrams. On the other hand, the information in propositional form concerning directly occurring events seems to be an appropriate interface between event-recognition and other components of a system for natural language description of time-varying real-world scenes.

Report No. 20
LST-1—Ein wissenbasiertes System zur
Durchfuehrung und Berechnung des
Lohnsteuerjahresausgleichs

Beiche, H.-P.

In Buchberger, E. and Retti, J. (eds.):
 3. *Oesterreichische Artificial-Intelligence-*
Tagung. Proceedings. Berlin/Heidelberg:
 Springer 1987, pp. 92-103.

LST-1 is a knowledge-based system in the field of German income tax. Its aim is to support a non-expert user in filling out an annual withholding tax adjustment form (which is displayed on the terminal screen). LST-1 checks the consistency of the data entered and advises the user on possible deductibles. The user has the possibility of filling out the form in a random order, or, be prompted by the system itself. As soon as the necessary data has been entered, partial results can immediately be computed upon request. LST-1 has been implemented using the BABYLON expert system shell, featuring frames, rules, PROLOG, and a restricted form of constraints as representational mechanisms.

Memo No. 8
MORPHIX—Ein hochportabler
Lemmatisierungsmodul fuer das
Deutsche

Finkler, W. and Neumann, G.

Morphologic analysis constitutes the first step in the processing of written language, with its relative importance in the parsing process depending upon the particular language to be analyzed. Since the German language belongs to a class in which a loose word order prevails, more grammatical information about a certain word can be obtained from an analysis of its inflected form rather than its position in the sentence. In order to reduce the size of lexica in natural language systems, morphological-analysis components trace back inflected word-forms to their canonic structures. Thereby, grammatical information is obtained about these words (e.g., category, gender, number, case, tense, mode, etc.) from which their possible grammatical roles can be determined. In this paper, the portable morphologic analysis module MORPHIX is introduced which, with respect to the German language, can be integrated into virtually any LISP-based natural-language system. After a general discussion of possible techniques for morphologic analysis in German and their realization in systems developed to date, the capabilities of Morphix and the organization of its lexicon are examined. Should a morphologic-analysis component be used as an independent module, high efficiency standards must be met. A detailed discussion is presented as to how the MORPHIX algorithm fulfills this requirement. Its central data structure is the GRIN (grammatical information) tree in which the relationship between suffixes and their respective grammatical content is efficiently coded. A "clarification dialog" is activated if a word-form cannot be processed by MORPHIX, and a semi-automatic augmentation of the lexicon carried out in interaction with the user.

Memo No. 9
AIDA—Rekursionsbehandlung,
Konfliktaufloesung und
Regelcompilierung in einem Deduktiven
Datenbanksystem
Portscheller, R.

The first chapter of this paper surveys the development from conventional relational database systems to deductive and expert database systems respectively. A number of fundamental design philosophies are outlined, and a precise definition of definite and indefinite deductive DBS is presented. The second chapter deals with the relationship between the "logical" programming language PROLOG and definite deductive DBS, as well as two realized definite deductive DBS which serve as front-ends to actual DBS. The AIDA system is presented in chapter 3. In order to optimize an a priori conflict-index, existentially quantified inquiries are proposed. Also, important approaches to the treatment of recursive rules are surveyed. An iterative fixed-point algorithm is recommended which allows a propagation of the constants contained within the inquiry and avoids redundant calculations. Moreover, inquiry-independent rule compilation is possible in AIDA. An algorithm was developed which accepts rules in any given order, with only those rules being compiled again which are actually affected by the new rules. A solution to the resulting consistency problems is given as well. The last chapter offers a summary of the results obtained and a look into the future development of the system.

Memo No. 10
MEGA-ACT—Eine Studie ueber
explizite Kontrollstrukturen und
Pseudoparallelitaet in Aktor-Systemen
mit einer Beispiellarchitektur in FRL.
Schirra, J.

MEGA-ACT is a program system which helps to examine the construction of explicit control structures and declarative programs built by them within actor systems. The starting point of our examination is to realize the massively parallel actor systems on "usual" computers with only one processor. The inherent reflexivity of the language use basic to actor systems—the so-called actor metaphor—allows for a sequentialization of the concurrent activities of actors by means of the actor system itself. For this purpose, it is necessary to render the representations of these actions (the programs) declarative, i.e., to render their structure accessible to the system—at least in certain parts. Hence, a complex of five actors, forming a general framework for explicit control structures, is introduced and partially described here. This is, in other words, a general element for constructing declarative programs in actor systems. Several instances of this so-called "Program-modul", which represent different control structures, are presented, and finally, an example illustrating the employment of parsing using ATNs is given.

Memo No. 11
Systemkonzeption zur Verarbeitung
kombinierter sprachlicher und
gestischer Referentenbeschreibungen.
Allgayer, J. and Redding, C.

See Report No. 12 (English version of the memo)

Memo No. 12
Ein Werkzeug zur Visualisierung und
Generierung von geometrischen
Bildfolgenbeschreibungen
Herzog, G.

Up to the present, no vision system is capable of constructing a complete geometric scene description for real-world image sequences. The absence of input data constitutes a serious problem for the development of natural language systems describing time-varying scenes. Another point is that the visual input data has to be converted from its numerical form into an adequate graphical representation in order to allow the user and the system designer to judge the performance of the natural

language system. In order to deal with this, the tool described in this report has been developed for the SOCCER domain of the VITRA project in which soccer games will be analyzed. By means of this program, geometric scene descriptions can be graphically re-represented and interactively generated or modified. Full utilization of the programming environment on the Symbolics Lisp Machine, which includes high resolution graphics as well as a mouse-aided window and menu system, enabled the design of a very comfortable user interface.

Memo No. 13
Deictic and Intrinsic Use of Spatial Prepositions: A Multidisciplinary Comparison

Retz-Schmidt, G.

In Kak, A. and Chen, S.-S. (eds.): *Spatial Reasoning and Multisensor Fusion, Proceedings of the 1987 Workshop*. Los Altos, CA: Morgan Kaufmann, 1987.

In this paper, principles involving the deictic and intrinsic use of spatial prepositions are examined from the viewpoint of linguistic, psychological, and artificial intelligence approaches. After a brief introduction to the natural-language dialog system CITYTOUR, important concepts with respect to the deictic and intrinsic use of prepositions are defined. In the following section, those prepositions that permit deictic as well as intrinsic use are listed, and the way CITYTOUR copes with them is explained. Then, the identification of the front, back, left, and right regions of a reference object is looked at in more detail. Finally, strategies concerning the deictic and intrinsic use of spatial concepts are pointed out.

Memo No. 14
A First Snapshot of XTRAGRAM, A Unification Grammar for German Based on PATR

Harbusch, K.

This paper describes XTRAGRAM, an almost purely syntactic grammar for parsing German sentences. The grammar is written in the PATR formalism and developed using the D-PATR workbench on a XEROX 1108 workstation. The discourse begins with an introduction to the PATR formalism in order to also allow people unfamiliar with unification to read the grammar. In the following section, XTRAGRAM is presented. First, all category and feature names are defined and all possible feature paths for the morphological categories are described. Then, the rules commended by their constructible feature paths, the words, the stems and the templates are defined. The linguistic coverage of the presented grammar is demonstrated by a variety of example DAG's. Finally, the paper closes with personal impressions received in working with the D-PATR workbench.

Memo No. 15
SYCON—Symbolische Constraint-Propagierung auf Netzwerken, Entwurf und Implementierung

Fendler, M. and Wichlacz, R.

Constraint propagation has prove to be an efficient processing technique in many branches of artificial intelligence. In this paper, the shell system SYCON will be presented with which arbitrary symbolic constraints can be defined and represented. After a brief introduction, it will be shown how constraints are defined and combined to form a network and, from there, how restrictions of variables are propagated upon constraint networks. Special algorithms for treating cycles as well as consistency-checks are presented. The main differences of SYCON as compared with the systems of Steele, Gosling, and Freuder are discussed. SYCON is implemented in LISP on a VAX 11/780 system.