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M. Elhadad and K. R. McKeown.

[CUCS-420-89] Extended functional unification programmars.

M. Elhadad.

[CUCS-421-89] A visual language for browsing, undoing and redoing graphical interface commands.

David Kurlander and Steven Feiner.

[CUCS-422-89] Energy-based segmentation of very sparse range surfaces.

Terrance E. Boult and Mark Lerner.

This paper describes a new segmentation technique for very sparse surfaces which is based on minimizing the energy of the surfaces in the scene. While it could be used in almost any system as part of surface reconstruction/model recovery, the algorithm is designed to be usable when the depth information is scattered and very sparse, as is generally the case with depth generated by stereo algorithms. We show results from a sequential algorithm and discuss a working prototype that executes on the massively parallel Connection Machine. The idea of segmentation by energy minimization is not new, however past techniques have relied on discrete regularization or Markov random fields to model the surfaces to build smooth surfaces and detect depth edges. In addition, both of the aforementioned techniques are ineffective at energy minimization for very sparse data. The technique presented herein models the surfaces with reproducing kernel-based splines which can be shown to solve a regularized surface reconstruction problem. From the functional form of these splines we derive computable upper and lower bounds on the energy of a surface over a given finite region. The computation of the spline, and the corresponding surface representation are quite efficient for very sparse data. An interesting property of the algorithm is that it makes no attempt to determine segmentation boundaries; the algorithm can be viewed as a classification scheme which segments the data into collections of points which are "from" the same surface.

[CUCS-423-89] Cost function error in asynchronous parallel simulated annealing algorithms.

M. D. Durand.

Reducing synchronization constraints in parallel simulated annealing algorithms can improve performance. However, this introduces error in the global cost function. Previous work in parallel simulated annealing suggests that if the amount of error in the cost function is controlled, good quality results can still be obtained. In this paper, we present a model of error in asynchronous parallel simulated annealing algorithms to partition graphs and use it to predict the behavior of three different synchronization strategies. These three approaches were implemented on a 20-processor Encore, a shared memory, MIMD multiprocessor, and tested on a variety of graphs. As predicted, the strategy which allows controlled error yields solutions comparable to those of the serial algorithm with greatly improved running time. Speedups from 5 to 11 (depending on the density of the graphs) using 16 processors were obtained. In contrast, the more synchronized version exhibited unacceptably high running times, whereas the version characterized by uncontrolled error yielded significantly poorer results. This confirms behavior seen in parallel simulated annealing algorithms to perform placement in VLSI circuit layout systems.

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Michael Sokolsky.

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Michael Sokolsky.

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Russell C. Mills.

[CUCS-430-89] A critique of the LLC parallel language and some solutions.

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[CUCS-431-89] DADO2 LLC users' manual.

Russell C. Mills.

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[CUCS-433-89] A tutorial introduction to LLC.

Russell C. Mills.

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Jonathan M. Smith and Gerald Q. Maguire Jr.

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Jonathan M. Smith and Gerald Q. Maguire Jr.

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[CUCS-441-89] Melding multiple granularities of parallelism.

Gail E. Kaiser, Wenwey Hseush, Steven S. Popovich, and Shyhtsun Felix Wu.

[CUCS-442-89] Concurrent execution of mutually exclusive alternatives (Ph.D. dissertation).

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[CUCS-445-89] A flexible transaction model for software engineering.

Gail E. Kaiser.

[CUCS-446-89] Experience with process modeling in the MARVEL software development environment kernel.

Gail E. Kaiser.

[CUCS-447-89] Data migration in software development environments.

Michael H. Sokolsky and Gail E. Kaiser.

[CUCS-448-89] Microcoding the lexicon with co-occurrence knowledge language generation, thesis proposal, June 89.

Frank Smadja.

[CUCS-449-89] Interactive multimedia explanation for equipment maintenance and repair.

Steven Feiner and Kathleen R. McKeown.

[CUCS-450-89] Support algorithms for incremental attribute evaluation of multiple asynchronous subtree replacements.

Josephine Micallef and Gail E. Kaiser.

[CUCS-451-89] Inductive learning with BCT.

Philip K. Chan.

BCT (Binary Classification Tree) is a system that learns from examples and represents learned concepts as a binary polythetic decision tree. Polythetic trees differ from monothetic decision trees in that a logical combination of multiple (versus a single) attribute values may label each tree arc. Statistical evaluations are used to recursively partition the concept space in two and expand the tree. As with standard decision trees, leaves denote classifications. Classes are predicted for unseen instances by traversing appropriate branches in the tree to the leaves. Empirical results demonstrated that BCT is generally more accurate or comparable to two earlier systems.

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Daniel J. Duchamp.

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[CUCS-461-89] The MELD programming language user manual.

Bill N. Schilit, Wen-Wey Hseush, Shyhtsun Felix Wu, and Steven S. Popovich.

[CUCS-462-89] The multicast policy and its relationship to replicated data placement.

Amir Milo and Ouri Wolfson.

In this paper we consider the communication complexity of maintaining the replicas of a logical data-item, in a database distributed over a computer network. We propose a new method, called the minimum spanning tree write, by which a processor in the network should multicast a write of a logical data-item, to all the processors that store replicas of the item. Then we show that the minimum spanning tree write is optimal from the communication cost point of view. We also demonstrate that the method by which a write is multicast to all the replicas of a data-item, affects the optimal replication scheme of the item, i.e., at which processors in the network the replicas should be located. Therefore, next we consider the problem of determining an optimal replication scheme for a data item, assuming that each processor employs the minimum spanning tree write at run-time. The problem for general networks is shown NP-Complete, but we provide efficient algorithms to obtain an optimal allocation scheme for three common types of network topologies. They are completely-connected, tree, and ring networks. For these topologies, efficient algorithms are also provided for the case in which reliability considerations dictate a minimum number of replicas.

[CUCS-463-89] A new paradigm for parallel and distributed rule-processing.

Ouri Wolfson and Aya Ozeri.

This paper is concerned with the parallel evaluation of datalog rule programs, mainly by processors that are interconnected by a communication network. We introduce a paradigm, called data-reduction, for the parallel evaluation of a general datalog program. Several parallelization strategies discussed previously in [CW, GST, W, WS] are special cases of this paradigm. The paradigm parallelizes the evaluation by partitioning among the processors the instantiations of the rules. After presenting the paradigm, we discuss the following issues, that we see fundamental for parallelization strategies derived from the paradigm: properties of the strategies that enable a reduction in the communication overhead, decomposability, load balancing, and application to programs with negation. We prove that decomposability, a concept introduced previously in [WS, CW], is undecidable.

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H. Wozniakowski.

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Andrea Danyluk.

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Zvi Galil and Kunsoo Park.

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Zvi Galil and Kunsoo Park.

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Z. Galil and G. F. Italiano.

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Amy Morishima and Thomas H. Speeter.

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Peter K. Allen.

[CUCS-476-89] The application of microeconomics to the design of resource allocation and control algorithms - Ph.D. dissertation.
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H. Abu-Amara, T. Balraj, T. Barzilai, and Y. Yemini.

[CUCS-478-89] NEST: A network simulation & prototyping testbed.
A. Dupuy, J. Schwartz, Y. Yemini, and D. Bacon.

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Kenneth S. Roberts.

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Yoelle S. Maarek and Frank A. Smadja.

[CUCS-486-89] Lexical co-occurrence: The missing link.

Frank A. Smadja.

[CUCS-487-89] A contrastive evaluation of functional unification grammar for surface language generation: A case study in choice of connectives.

Kathleen R. McKeown and Michael Elhadad.

[CUCS-488-89] Radio project user model (version 1.0).

Matthew Kamerman.

[CUCS-489-89] FUF: The universal unifier – user manual, version 2.0.

Michael Elhadad.

[CUCS-490-89] Learning the probability distribution for probabilistic expert systems.

Michelle Baker and Kenneth Roberts.

[CUCS-491-89] An algorithm to recover generalized cylinders from a single intensity view.

Ari D. Gross and Terrance E. Boult.

[CUCS-492-89] An optimal $o(\log\log n)$ time parallel string matching algorithm.

Dany Breslauer.

[CUCS-493-89] Image understanding and robotics research at Columbia University.

John R. Kender, Peter K. Allen, and Terrance E. Boult.

[CUCS-494-89] Recovery of straight homogeneous generalized cylinders from a single intensity view.

Ari Gross.

[CUCS-495-89] Shape from textures: A paradigm for fusing middle level vision cues – Ph.D. dissertation.

Mark Laurence Moerdler.

[CUCS-496-89] User-defined predicates in OPS5: A needed language extension for financial expert systems.

A. J. Pasik, D. P. Miranker, S. J. Stolfo, and T. Kresnicka.

[CUCS-497-89] Techniques for building highly available distributed file systems.

Carl D. Tait.

This paper analyzes recent research in the field of distributed file systems, with a particular emphasis on the problem of high availability. Several of the techniques involved in building such a system are discussed individually: naming, replication, multiple versions, caching, stashing, and logging. These techniques range from extensions of ideas used in centralized file systems, through new notions already in use, to radical ideas that have not yet been implemented. A number of working and proposed systems are described in conjunction with the analysis of each technique. The paper concludes that a low degree of replication, a liberal use of client and server caching, and optimistic behavior in the face of network partition are all necessary to ensure high availability.

[CUCS-498-89] MARVEL users manual, version 2.5.

Michael Sokolsky and Mara Cohen.

[CUCS-499-89] The communication complexity of atomic commitment and of gossiping.

Ouri Wolfson.

We consider the problem of atomic commitment of a transaction in a distributed database. This is a variant of the famous gossiping problem (see [HHL] for a survey). Given a set of communication costs between pairs of participant sites, we establish that the necessary communication cost for any atomic commitment algorithm is twice the cost of a certain minimum spanning tree. We also establish the necessary communication time for any atomic commitment algorithm, given a set of communication delays between pairs of participant sites, and the time at which each participant completes its subtransaction. Then we determine that both lower bounds are also upper bounds in the following sense. There is an efficient (i.e. polynomial-time) algorithm that, in the absence of failures, has a minimum communication cost. There is another efficient algorithm that, in the absence of failures, has a minimum communication time. However, unless P=NP, there is no efficient algorithm which has a minimum communication complexity, namely, for which the product of communication cost and communication time is minimum. Then we present a simple, linear time, distributed algorithm, called TREE-COMMIT, whose communication complexity is not worse than p times the minimum complexity, where p is the number of participants. Finally, we demonstrate that TREE-COMMIT is superior to the existing variations of the two-phase commit protocol.

[CUCS-500-89] Surface orientation from texture autocorrelation.

Lisa Gottesfeld Brown.

We report on a refinement of our technique for determining the orientation of a textured surface from the two-point autocorrelation function of its image. We replace our previous assumptions of isotropic texture by knowledge of the autocorrelation moment matrix of the texture when viewed head on. The orientation of a textured surface is then deduced from the effects of foreshortening on these autocorrelation moments. This technique is applied to natural images of planar textured surfaces and gives significantly improved results when applied to anisotropic textures which under the assumption of isotropy mimic the effects of projective foreshortening. The potential practicality of this method for higher level image understanding systems is discussed.

[CUCS-501-89] Camera placement planning avoiding occlusion: Test results using a robotic hand/eye system.

Kostantinos Tarabanis and Roger Y. Tsai.

Camera placement experiments are presented that demonstrate the effectiveness of a viewpoint planning algorithm that avoids occlusion of a visual target. A CCD camera mounted on a robot in a hand-eye configuration is placed at planned unobstructed viewpoints to observe a target on a real object. The validity of the method is tested by placing the camera inside the viewing region, that is constructed using the proposed new sensor placement planning algorithm, and observing whether the target is truly visible. The accuracy of the boundary of the constructed viewing region is tested by placing the camera at the critical locations of the viewing region boundary and confirming that the target is barely visible. The corresponding scenes from the candidate viewpoints are shown demonstrating that occlusions are properly avoided.

[CUCS-502-89] Model-based planning of sensor placement and optical settings.

Kostantinos Tarabanis and Roger Y. Tsai.

We present a model-based vision system that automatically plans the placement and optical settings of vision sensors in order to meet certain generic task requirements common to most industrial machine vision applications. From the planned viewpoints, features of interest on an object will satisfy particular constraints in the image. In this work, the vision sensor is a CCD camera equipped with a programmable lens (i.e. zoom lens) and the image constraints considered are: visibility, resolution and field of view. The proposed approach uses a geometric model of the object as well as a model of the sensor, in order to reason about the task and the environment. The sensor planning system then computes the regions in space as well as the optical settings that satisfy each of the constraints separately. These results are finally combined to generate acceptable viewing locations and optical settings satisfying all constraints simultaneously. Camera planning experiments are described in which a robot-arm positions the camera at a computed location and the planned optical settings are set automatically. The corresponding scenes from the candidate viewpoints are shown demonstrating that the constraints are indeed satisfied. Other constraints, such as depth of focus, as well as other vision sensors can also be considered resulting in a fully integrated sensor planning system.

[CUCS-503-89] Extending the *mercury* system to support teams of Ada programmers.

Josephine Micallef and Gail E. Kaiser.

[CUCS-504-89] Synchronization of multiple agents in rule-based development environments – thesis proposal.

Naser S. Barghouti.

The Rule-Based Development Environment (RBDE) is a recently-developed approach for providing intelligent assistance to developers working on a large-scale software project. RBDEs model the development process in terms of rules, and then enact this model by automatically firing rules at the appropriate time. The RBDE approach has been used to develop single-user environments, but support for multiple developers cooperating on the same project is still not available because of the lack of mechanisms that can synchronize the efforts of multiple developers, who concurrently select commands, causing the firing of multiple rules (either directly or via chaining) that concurrently access shared data. Conflicts between different rules and concurrent access to shared data may cause the violation of consistency in the project database, and thus necessitate the synchronization of concurrent activities. The conjecture of this proposal is that an RBDE can provide the required synchronization if it is provided with knowledge about what it means for the data of a specific project to be in a consistent state, and about the semantics of operations that developers perform on the data. The research that this paper proposes will formulate a framework for specifying consistency of data in an RBDE, and formulate a mechanism for synchronizing the actions of concurrent rules fired on behalf of multiple developers cooperating on a common or different tasks.

[CUCS-505-89] Netmate object model.

A. Dupuy, S. Sengupta, and O. Wolfson.

[CUCS-506-89] Netmate network model.

A. Dupuy, S. Sengupta, and O. Wolfson.

The Netmate network model is an object-oriented architecture for storing and managing information about communications networks. It is sufficiently general to permit modeling a wide variety of networks with the same structures, allowing the development of generic network management tools. The architecture is extensible, and examples of several user-defined models are given.

[CUCS-507-89] Acquiring syntagmatic lexical relations for natural language generation: Xtract.

Frank Smadja.

[CUCS-508-89] Surface orientation from a binocular polarization based stereo method.

Lawrence B. Wolff.

[CUCS-509-89] Parallel bottom-up evaluation of Datalog programs by load sharing.

Ouri Wolfson.

We propose a method of syntactically parallelizing bottom-up-evaluation of logic programs. The method is distinguished by the fact that it is .i pure i.e., does not require interprocessor communication, or synchronization overhead. The method cannot be used to parallelize every logic program, but we syntactically characterize several classes of logic programs that are *sharable*, i.e. programs to which the method can be applied (e.g., the class of linear single rule programs). We also provide a characterization of a class of *nonsharable* programs, and demonstrate that sharability is a fundamental semantic property of the program, that is independent of the parallelization method proposed in this paper.

[CUCS-510-89] Image-flow computation: Estimation-theoretic framework, unification and integration, thesis proposal.

Ajit Singh.

Visual-motion is a major source of three-dimensional information. It is commonly recovered from time-varying imagery in the form of a two-dimensional image-flow field. This thesis is about computation of image-flow. A new framework is proposed that classifies the image-flow information available in time-varying imagery into two categories - conservation information and neighborhood information. Each type of information is recovered in the form of an estimate accompanied by a covariance-matrix. Image-flow is then computed by fusing the two estimates using estimation-theoretic techniques. This framework is shown to allow estimation of certain types of discontinuous flow-fields without any a-priori knowledge about the location of discontinuities. An algorithm based on this framework is described. Results of applying this algorithm to a variety of image-sequences are also discussed. The new framework is shown to be applicable identically to each one of the three major approaches for recovering conservation information, i.e., gradient-based approach, correlation-based approach and spatiotemporal energy-based approach. The formulation of neighborhood information used in this framework is also shown to reduce to some of the existing smoothing-based formulations under various simplifying assumptions. In essence, the framework described in this thesis unifies various existing approaches for image-flow computation. Such unification is shown to be useful in analyzing various existing frameworks as well as in generating new frameworks. The new framework is also shown to serve as a platform to integrate the three approaches mentioned above. It is observed that the measurements obtained by the three approaches have different error-characteristics. This situation is regarded analogous to the multi-sensor fusion problem, where the algorithms based on the three approaches behave as multiple sensors measuring image-flow. An integrated framework is described that applies the principles of statistical estimation theory to fuse the measurements obtained from different approaches. The resulting estimate of image-flow has the minimum expected-error. Some algorithms based on this framework are described. Several proposals for extension of this thesis are also included.

[CUCS-511-89] Integrated analytic and empirical learning of approximations for intractable theories - *ph.d.* dissertation.

Thomas Ellman.

[CUCS-512-89] Models of software development environments.

Dewayne E. Perry and Gail E. Kaiser.

[CUCS-513-89] Automatically generating software libraries without pre-encoded knowledge.

Yoelle S. Maarek, Daniel M. Berry, and Gail E. Kaiser.

[CUCS-514-89] An object model for shared data.

Gail E. Kaiser and Brent Hailpern.

[CUCS-515-89] *AI* techniques in software engineering.

Gail E. Kaiser.

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