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CELLULAR AUTOMATA FOR EDGE DETECTION
Sartra Wongthanavasu
Prof. Ramakoti Sadananda

Cellular Automata (CAs) are spatiotemporal dynamic complex systems that can serve as an alternative framework for the modeling of physical and biological systems. Furthermore, they constitute intrinsically parallel models of computation that can break through the von Neumann bottleneck and be efficiently realized with special-purpose cellular automata machines. In this study, image processing is the domain of interest throughout: the basic objective is to determine techniques for using CAs to model digital images, and to extract edge features on binary and 256 gray-scale images by utilizing general-purpose hardware. In addition, the rule space, state space, and computation model of the proposed CA are investigated in depth. The computation complexity, computation times, and edge-maps quality for the proposed CA-based model are realized. In these respects, a number of well-known edge operators are evaluated and compared.

The origins, topology, and modeling categories of the CAs, which are necessary for an understanding of the basic ingredients our work, are investigated. A two-dimensional CA with a regular configuration using a von Neumann neighborhood-based rule is presented, which carries out edge detection on binary images. A transition matrix algebraically defined a transition function associated with the proposed CA is given. It determines the characteristic polynomial, which explains the properties of the CA state space. In addition, two state-vector transition property and an activity relation between Hamming distance and evolution time steps are also comprehensively analyzed to explain the proposed CA state space. Analyses of the CA computation model using a state graph and a finite state machine are provided in depth. Furthermore, a deterministic finite automaton (DFA) associated with the state graph as a recogniser machine is constructed for determining if a particular configuration can be made possible by the given CA rule.

The CA rule for edge detection on binary images is extended to carry out 256 gray-scale images. Surprisingly, both are the same, but deal with different state spaces. In addition, the computation complexity of the CA-based model using the analyzing method is investigated, and the results are confirmed through simulation. For evaluating performance characteristics of the proposed CA-based model, a number of distinguished edge detectors (Canny, Laplace, Sobel, and Kirsch) is evaluated and compared in term of computation times, computation complexity, and edge-maps quality. On the basis of key issues in the comparative evaluations, our work shows that the CA-based model provides an optimum edge map on binary images, and on average is better than the compared edge operators for 256 gray-scale images.

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A UNIFIED VERSION MODEL OF SOFTWARE CONFIGURATION MANAGEMENT
Supanat Kitcharoensakkul
Prof. Vilas Wuwongse

Version controls of the existing Software Configuration Management (SCM) systems employ different version models without a common foundation – framework for representation and computation of basic information, which causes the problems of system interchangeability, interoperability, and integrability. Hence a SCM foundation demands a unified version model. With the aim of developing a practical solution, the representation and computation of the proposed version model are based on Resource Description Framework (RDF)/RDF Programs and Equivalent Transformation (ET) computational model, respectively. RDF and RDF Programs can be employed to represent all version control approaches including State-based and Change-based versioning as well as Extensional and Intensional approaches and uniformly expresses evolution of software objects and their relationships. The model is general and embraces existing models as special cases, whence, besides serving as an internal representation scheme, it can serve as interchange format for different SCM systems and for system interoperation and integration. Moreover, since RDF is a core technology for the Semantic Web, it facilitates linkage to other systems on the Internet. Its use of ET introduces powerful operations for uniform formulation of all basic SCM operations. The model's potential is demonstrated by a simple prototype.

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XML DECLARATIVE DESCRIPTION
Chutiporn Anutariya
Prof. Vilas Wuwongse

XML is a description format for encoding and exchange of structured data and documents on the Web, which lacks a computation mechanism as well as expressiveness by not allowing specification of domain knowledge, axioms, conditional relationships and constraints. Existing approaches to the removal of these limitations demand certain extensions as well as integration of additional formalisms, which not only complicate their syntax and semantics, but also their understanding.

With the aim of removal of these defects, XML Declarative Description (XDD)—an expressive knowledge representation with precise, well-defined semantics and efficient computation mechanism—employs XML's nested tree structure as its underlying data structure and Declarative Description theory as a framework to enhance its expressive power. It enables direct representation of data items, encoded in XML-based application markup languages, and extends their expressiveness by facilitation of simple means for succinct and uniform expression of implicit information, integrity constraints, conditional relationships and axioms. In addition, it allows their semantics to be determined directly, and also provides efficient computation by means of Equivalent Transformation (ET). Thus, with its simplicity, yet flexibility, generality and expressiveness, XDD embraces those existing approaches and can serve as their foundation for representation and computation. XDD can be applied to diverse areas including XML document manipulation, database management, query formulation and evaluation as well as Semantic Web modeling and programming.

Application of XDD to XML (document) database modeling allows the three components of an XML database—an extensional database, an intensional database, and structural and integrity constraints—to be formalized simply as an XDD description; its semantics is a set of XML elements which are explicitly described by the extensional database or implicitly derived from the database, based on the defined intensional database, and which satisfy all the specified constraints. Thus, selective and complex queries, regarding information satisfying certain criteria and possibly implicit in the database, formulated as XDD descriptions, become expressible and computable. Moreover, since a DTD or an XML Schema can be represented by a corresponding XDD description, it also yields an algorithm for validation of document conformance. XDD thereby serves as an effective and well-founded XML database framework with succinct representational and operational uniformity, reasoning capabilities and deductive query supports. The present XDD approach to modeling of Semantic Web resources and applications demonstrates that every component of Semantic Web resources—constraints, ontologies and contents—and of Semantic Web applications—application data, application rules and queries/requests—can be represented uniformly as an XDD description.