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Comparative Religion in Character Recognition Machines
(p. 3) “It is the intent of this paper to describe a few of these different philosophies which are hopefully common to most of the ideas. This is done by introducing the concept of ‘stage analysis.’ ... Stage analysis is a way of classifying character recognition machinery with a minimum of references to the specific components used. ... A stage consists in general of an ‘image’ (may be in optical, magnetic, or electronic form), one or more operations upon that image, and a decision. This is illustrated in Figure 1. ... III. Machine Descriptions: In this section we will attempt to turn the tables on reading machines by categorizing the categorizers. The most important material is contained in Tables 1, 2, and 3, while the text is mainly commentary. ... V. Conclusion: This brief discussion has concentrated on pointing out some of the significant similarities and differences between central recognition philosophies. One point, in particular, stands out: the number of stages used seems to be proportional to the complexity of the character recognition problem.” [Editor’s note: The article presents a detailed discussion of both the mechanical and electronic concepts of various character recognition machines available on the market in 1968. To me, the stages identified are via various decision points in the recognition process—for example, stage 1, pixel recognition with black and white decisions; stage 2, identification of characters from these pixels. Interestingly, the approaches all relied on analog processing at the various stages. No digital processing is discussed in the paper.]

Digital Computer Simulation of Coherent Optical Processing Operations (p. 12) “Coherent optical processing operations can be performed on a digital computer, since the Kirchhoff diffraction integral, describing the imaging process of a lens, can be expressed as a discrete two dimensional Fourier transform. The advantages of optical processing on a computer are increased accuracy and operational flexibility. Applications of computer optical processing described herein include the calculation of aperture diffraction patterns, spatial filtering for image noise reduction, character recognition, and holography. ... Since the operation performed by a lens in the coherent optical system can be described by a Fourier transform equation, it is possible to perform optical processing on a digital computer by evaluating the two dimensional Fourier transform of a function mathematically. ... The performance of the digital optical processing technique has been verified experimentally. ... Conclusions: Digital computer simulation of coherent optical processing operations has become feasible with the fast Fourier transform computer algorithm. The simulation technique offers increased accuracy and greater operational flexibility compared to optical processing with lenses and transparencies.” Sections of the discussions are: “Fourier Transforming of Images ... Aperture Diffraction Patterns ... Spatial Filtering ... Pattern Recognition ... Holography.” [Editor’s note: It is interesting to note that, in 1998, most character recognition machinery relied on optical mechanisms and analog (logical) processing of the results, and the idea of digital processing was a novel one and had to be shown to be effective. Few of us would doubt that idea today.]

Large Scale Integration Perspectives (p. 24) “LSI is a physical reality, yet it has a long way to go to reach the impact so often forecast. Perhaps this LSI ‘revolution’ will be more in terms of its influence on the whole gamut of activities from system architecture to hardware assembly, and from marketing to servicing, rather than in terms of its direct effects on computer hardware cost per se. ... The significance of large scale is that integrally fabricating components results in many fewer pieces of circuit hardware and many fewer interconnections for given circuit functions. Components have many additional design constraints, but potential for much lower cost and improved reliability per function compared with a single circuit, logic gate, or memory makes it worthwhile. Certainly, 100 logic gates per chip is an adequate level to meet this test of large scale. Even higher levels of integration apply to memory. ... LSI systems can be built today. Today, the
practical applications are very limited and most would have marginal benefits. Of course, they form the indispensable thread necessary to develop not only the hardware but the application understanding and implementation procedures. The major systems impact must await the time when LSI costs are a small fraction of competitive approaches. Today, such is not the case, in general.” [Editor’s note: From today’s view of technology, the “LSI” definition of 1968 appears way off the mark of the future to come. However, the paper discusses issues that are still relevant today and, in its outlook, more philosophically discusses the potential of LSI to make computer power available for the general public. Just think now of the smartphone environed only in the science fiction literature and movies of that time!]

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**Lattice-Based Access Control Models** (p. 9): “Although developed for the defense sector, lattice-based access controls can be used in most circumstances where information flow is critical. They are a key component of computer security. ... Figure 1(d) shows a partially ordered lattice. The security classes are obtained as the power set (that is, set of all subsets) of {A, B}. Say A denotes salary information and B denotes medical information in a personnel database. The system-low class is the empty set, which can have public information but no salary or medical information. ... Although lattice-based access controls were initially developed for the military sector, they can be applied in almost any situation where information flow is of concern. The commercial sector has largely ignored lattice-based access controls, possibly due to their genesis in confidentiality policies for the military and government. However, as I have argued in this article, lattice-based controls are relevant to integrity policies in commercial data processing, as well as for confidentiality policies that are unique to the commercial sector. Lattice-based access control is a key ingredient of information systems security as we understand it today. At the same time, the lattice-based approach does not provide a complete solution for information flow policies, let alone for security policies in general. Albeit a very important one, the lattice-based approach is but one ingredient of information systems security.” [Editor’s note: The article discusses the different levels of lattice-based access control but does not discuss the previously mentioned additional aspects of security control, as, for example, encryption.]

**Iterative User-Interface Design** (p. 32) “Four case studies show that redesigning user interfaces on the basis of user testing—iterating through at least three versions—can substantially improve usability. ... Unfortunately, even after the iterative design had been through 14 versions, test users still said they were intimidated and frustrated by the system. At this stage, the designers decided to abandon the basic interface design, which was based on a command-line interface. From the insight that the command line made the system’s structure invisible to the user, they reconceptualized the interface. The redesigned interface had a menu of services displaying all options at all times, thus making them visible and presumably easier to understand. User satisfaction on a 1-to-5 rating scale (where 5 corresponded to “like very much”) increased from 3.4 for the command-line-based version to 4.2 for the menu-based version, indicating a drastic improvement in usability for the reconceptualized interface. ... Home banking. ... The relevant usability attributes for this application include user task performance, the users’ subjective satisfaction, and the number of errors users made ... Of course, the 38% improvement between versions in iterative design is only a rough estimate based on four case studies. Furthermore, there is a large variability in the magnitude of usability improvement from case to case, so we should not expect a 38% improvement in every case. Also, we should not expect to sustain exponential improvements in usability across iterations indefinitely.” [Editor’s note: The article explains and analyzes the user satisfaction improvements throughout a number of system versions where each of the changes made is explained in detail.]

**Systems Engineering of Computer-Based Systems** (p. 54) “This working group report defines the need for a discipline devoted to engineering of computer-based systems, identifies current practice and needed research, and suggests improvements that are achievable today. ... Developing large computer-based systems with complex dynamics and component interdependencies requires analysis of critical end-to-end processing flows to determine feasibility and proper allocation. Currently, no engineering discipline provides the knowledge base for the necessary tradeoff studies concerning software, hardware, and communication components; a new discipline is needed at the systems engineering level. ... Various modeling approaches augment text specification with semantically precise representations for engineering information. Since modeling and model analysis can provide a grand-scale improvement in the process of constructing systems, we must quickly and economically close the gap between current text-based practice and future model-based practice. Closing the gap means an extensive cultural change and substantial retraining.” [Editor’s note: The report discusses many of the aspects needed in modern systems engineering approaches. Since 1993, the understanding has been that systems engineering is an essential component when developing today’s complex systems and will help in keeping money, time, and quality under better control.]

**Who Holds the Cryptographic Keys? The Government Key Escrow Initiative of 1993** (p. 76) “In 1991, the US government pushed legislation to require significant changes in computer hardware, software, and communications equipment so that law enforcement could maintain listening
capabilities in the increasingly digital telephone network. ... Now the FBI and its allies in the intelligence community have persuaded President Clinton to pursue a course that, if not reversed, may achieve the same goal at a great cost to civil liberties. The plan involves effectively building ‘Big Brother’ capabilities into the computer/telephone network of the future with an encryption device for telephones and other computer network peripherals. ... The administration should halt the introduction of its key escrow system and reconsider this half-baked scheme, which was hatched during the previous administration.” [Editor’s note: These debates mostly died down after 1993 amid an intensive public conversation over the problems encountered in such a system. Unfortunately, with some of the recent happenings (for example, Apple not offering decryption keys to the government), the discussion has been resumed—of course, with the same problems of security, safety, and privacy envisioned before.]

Digital Libraries (p. 79) “The library of the future. The technology required to develop and provide access to digital libraries is becoming available rapidly. ... some agreed-upon guidelines should be established for building digital libraries. One crucial issue is object reuse; we need to encourage authors to share high-level objects ... instead of page images.” [Editor’s note: This article focuses the attention of the research community on digital libraries. The interest was reflected in 1994 by the creation of two digital conferences—the ACM Digital Library Conference and IEEE Conference on Advances in Digital Libraries—that merged in 2001 into the ACM/IEEE Joint Conference on Digital Libraries, still alive today.]