Computer Highlights Society Magazines

The IEEE Computer Society’s lineup of 13 peer-reviewed technical magazines covers cutting-edge topics ranging from software design and computer graphics to Internet computing and security, from scientific applications and machine intelligence to cloud migration and microchip design. Here are highlights from recent issues.

Math.js: An Advanced Mathematics Library for JavaScript
Math.js is a JavaScript library that brings advanced mathematics to the web browser and server. The case study presented in this article from the January/February 2018 issue of CiSE demonstrates its flexibility by extending the library with custom functions to solve and optimize a rocket trajectory. Several benchmark comparisons with other JavaScript libraries and state-of-the-art mathematics software are presented, as well as the current challenges facing math.js, including performance and size.

The Homebrew Computer Club was a hobbyist group in the San Francisco Bay Area dedicated to helping people build their own home personal computers. In this article from the October–December 2017 issue of IEEE Annals, Elizabeth Petrick from the New Jersey Institute of Technology analyzes their writings between 1975 and 1977 to understand how their values became embedded in the technology they built, establishing how the personal computer should be used and thought of. These values were based on ideals of open information, access to computers, and the computer as a universal tool, while also allowing for development of entrepreneurial ambitions to market the computer as a consumer product.

Context-Aware Ubiquitous Biometrics in the Edge of Military Things
Edge computing can play a crucial role in enabling user authentication and monitoring through context-aware biometrics in military and battlefield applications. For example, in the Internet of Military Things or Internet of Battlefield Things, an increasing number of ubiquitous sensing and computing devices worn by military personnel and embedded within military equipment—such as combat suits, instrumented helmets, and weapons systems—are capable of acquiring a variety of static and dynamic biometrics like visual features, fingerprints, heart rate, gait, gestures, and facial expressions. Such devices might also be capable of collecting operational context data that can be used to perform context-adaptive authentication in the wild and continuous monitoring of soldiers’ mental and physical conditions in a dedicated edge computing architecture. Learn more in this article from the November/December 2017 issue of IEEE Cloud Computing.

A Generative Audio-Visual Prosodic Model for Virtual Actors
An important problem in the animation of virtual characters is the expression of complex mental states using the coordinated prosody of voice, rhythm, facial expressions, and head and gaze motion. The authors of this article from the November/December 2017 issue of IEEE CG&A propose a method for generating natural speech and facial animation in various attitudes using neutral speech and animation as input.
Robots in Retirement Homes: Person Search and Task Planning for a Group of Residents by a Team of Assistive Robots

In this article from the November/December 2017 issue of IEEE Intelligent Systems, researchers from the University of Toronto present a general multi-robot task planning and execution architecture for a team of heterogeneous mobile robots that interact with multiple human users. The architecture is implemented in an environment where such robots provide daily assistance to residents in a retirement-home setting. The robots are able to allocate and schedule activities throughout the day and find the appropriate residents with whom to engage in assistive activities.

Internet of Things–Enhanced User Experience for Smart Water and Energy Management

Smart environments can engage a wide range of end users with different interests and priorities, from corporate managers looking to improve the performance of their business to school children who want to explore and learn more about the world around them. Creating an effective user experience within a smart environment (from smart buildings to smart cities) is an important factor to success. In this article from the January/February 2018 issue of IEEE Internet Computing, researchers reflect on their experience of developing Internet of Things–enabled applications within a smart home, school, office building, university, and airport, where the goal has been to engage a wide range of users (from building managers to business travelers) to increase water and energy awareness, management, and conservation.

High-Integrity Performance Monitoring Units in Automotive Chips for Reliable Timing Validation and Verification

As software continues to control more system-critical functions in cars, its timing is becoming an integral element in functional safety. Timing validation and verification (V&V) assesses software’s end-to-end timing measurements against given budgets. The advent of multicore processors with massive resource sharing reduces the significance of end-to-end execution times for timing V&V and requires reasoning on worst-case access delays on contention-prone hardware resources. While performance monitoring units (PMUs) support this finer-grained reasoning, their design has never been a prime consideration in high-performance processors. In this article from the January/February 2018 issue of IEEE Micro, researchers advocate for PMUs in automotive chips that: explicitly track activities related to worst-case software behavior, are recognized as a mandatory high-integrity hardware service, and are accompanied with detailed documentation that enables their effective use to derive reliable timing estimates.

Word of Mouth Mobile Crowdsourcing: Increasing Awareness of Physical, Cyber, and Social Interactions

By fully exploring various sensing capabilities and multiple wireless interfaces of mobile devices and integrating them with human power and intelligence, mobile crowdsourcing (MCS) is emerging as an effective paradigm for large-scale multimedia-related applications. However, most MCS schemes use a direct mode, in which crowd workers passively or actively select tasks and contribute without interacting and collaborating with each other. This can hamper some time-constrained crowdsourced tasks. In this article from the October–December 2017 issue of IEEE MultiMedia, researchers from universities in China, Japan, and Sweden execute a different approach: MCS based on word of mouth (WoM), in which workers, apart from executing tasks, exploit their mobile social networks and/or physical encounters to actively recruit other appropriate individuals to work on the task.

Designing Line-Based Shape-Changing Interfaces

In this article from the October–December 2017 issue of IEEE Pervasive Computing, researchers from Stanford and the MIT Media Lab present an overview of work on shape-changing line interfaces in the field of human–computer interaction (HCI), including their previous work on actuated-line interfaces (LineFORM and ChainFORM). They compare several potential implementation methods, discuss their potential for future research and applications, investigate the interaction design space around actuated line interfaces, and present potential applications and demonstrate their use with the LineFORM and ChainFORM prototypes. Envisioning a future where shape-changing lines are woven into daily life, this article aims to explore and initiate a broad research space around line-based shape-changing interfaces and to encourage future researchers and designers to investigate these novel directions.
Elsewhere in the CS

**Security & Privacy**

Enhancing Selectivity in Big Data

Today’s companies collect immense amounts of personal data and enable wide access to it within the company. This exposes the data to external hackers and privacy-transgressing employees. In this article from the January/February 2018 issue of *IEEE S&P*, researchers show that, for a wide and important class of workloads, only a fraction of the data is needed to approach state-of-the-art accuracy. They propose selective data systems that are designed to pinpoint the data that is valuable for a company’s current and evolving workloads. These systems limit data exposure by setting aside the data that is not truly valuable.

**IT Professional**

Automatic Annotation of Text with Pictures

The vast array of information available on the Internet makes it challenging to quickly determine the importance and relevance of content. Text picturing is a cognitive aid that can help with text understanding, as it helps users decide if the text deserves a closer look by showing relevant pictures along with the text. Learn more in this article from the January/February 2018 issue of *IT Professional***.

**Software**


NASA has been successfully sustaining the continuous operation of its critical navigation software systems for over 12 years. To accomplish this, NASA scientists must continuously monitor their process, report on current system quality, forecast maintenance effort, and sustain required staffing levels. In this article from the January/February 2018 issue of *IEEE Software*, the authors present some examples of the use of a robust software metrics and analytics program that enables actionable strategic maintenance management of a critical system (Monte) in a timely, economical, and risk-controlled fashion.

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