wand-like telemetry device that transmits information to a patient database. A rapid rise in filling pressure, for example, could be a warning sign for an arrhythmia, but if a healthcare professional were alerted in real time, he or she could proactively adjust the patient's medicine or schedule an appointment. "If patients have to be monitored by a specialist every day, that's not practical," Najafi says. "This way, you can look at the data over the last two weeks, and based on that, you can adjust the medications."

The Future

The timeline for when these sensors become a regular part of patient care is unclear, but the researchers paint a fascinating picture of their potential. Najafi hopes he and his group will be able to build devices that could be safely implanted in children with severe heart problems and last 30 to 50 years. Other scientists are designing wireless implants that will be application-agnostic. A multidisciplinary group at Brown University, for example, is building a high-throughput device that could potentially work with any type of sensor.

The neural dust group has taken a similar approach, but Maharbiz says it is also moving closer to its original goal of building devices that continually read neuronal activity in key parts of the brain, and allow subjects to control their prosthetics as if they are their own limbs. Indeed, the group has published a proof-of-concept study showing the motes could be shrunk to half the width of an average human hair, which would open up a whole new realm of possibilities.

"If I think forward and dream a little bit," says Maharbiz, "I really do think the amount of integration between what we today consider synthetic and what we consider organismal or biological is going to be extremely high."

Further Reading

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Baranowski, J., Delshad, B., Ahn, H.C.
An Implantable Pressure Sensor for Long-term Wireless Monitoring of Cardiac Function – First Study in Man. *Journal of Cardiovascular Diseases & Diagnosis*, Vol. 4, Issue 4, 2016.

Ledet, E., et. al.
Elementary Implantable Force Sensor for Smart Orthopaedic Implants. *Advances in Biosensors and Bioelectronics*, Volume 2, Issue 4, 2013.

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Milestones

USACM on Algorithmic Bias, Accountability

Algorithms, the set of instructions computers employ to carry out a task, influence almost every aspect of society. The explosive growth of data collection, coupled with increasingly sophisticated algorithms, has yielded a significant increase in automated decision making, as well as a greater reliance on algorithms in human decision making. Industry forecasters believe software programs incorporating automated decision making will only increase in the coming years as artificial intelligence becomes more mainstream.

One of the major challenges of this emerging reality is to ensure that algorithms do not reinforce harmful and/or unfair biases.

Examples of potential algorithmic bias include:

1. Job web sites: Do these sites send more listings of high-paying jobs to men than to women?

2. Credit reporting bureaus: Does the dataset that algorithms weigh in determining credit scores contain prejudicial information?

3. Social media sites: What factors determine the news items that are served up to users?

4. The criminal justice system: Are computer-generated reports that influence sentencing and parole decisions biased against African Americans?

Recognizing the ubiquity of algorithms in our daily lives, as well as their far-reaching impact, the ACM U.S. Public Policy Council (USACM) has issued a statement and a list of seven principles designed to address potential harmful bias. The goals of the statement include providing context for what algorithms are, how they make decisions, and the technical challenges and opportunities to prevent and mitigate potential harmful bias.

USACM is the focal point for ACM's interaction with U.S. government organizations, the computing community, and the public in matters of U.S. public policy related to computing and information technology.

The USACM statement (available in full at http://www.acm.org/binaries/content/assets/public-policy/2017_usacm_statement_algorithms.pdf) asserts that these principles should guide every phase of software system development and deployment. "Algorithmic bias can occur even with the best of intentions," said USACM Chair Stuart Shapiro. "This is, in part, due to the fact that both software development and its products can be complex and produce unanticipated results. Following these principles cannot guarantee that there will be no biased algorithms or biased outputs. But they will serve to keep computing professionals on the lookout for ways biases could creep into systems and provide guidelines on how to minimize the potential for harm."

The Statement on Algorithmic Transparency and Accountability was designed to be consistent with ACM's Code of Ethics. The effort was initiated by USACM's Algorithmic Accountability Working Group.

USACM is organized around a committee structure. Each member of USACM serves on at least one committee. Policy statements originate at the committee level before being approved by the full USACM Council. USACM's seven committee areas are: Privacy, Security, Intellectual Property, Law, Accessibility, Digital Governance, and Voting. In June, the Council approved the addition of three new working groups to reflect the continuing rapid evolution of the technology landscape: Internet of Things (IoT), Big Data, and AI/Algorithmic Accountability.

ACM TO CELEBRATE 50 YEARS OF TURING AWARD

During the next several months, ACM will celebrate 50 years of the ACM A.M. Turing Award and the visionaries who have received it.

The aim is to highlight the significant impact of the contributions of the Turing Laureates on computing and society, to look ahead to the future of technology and innovation, and to help inspire the next generation of computer scientists to invent and dream.

The celebration will culminate with a conference on June 23–24 at the Westin St. Francis in San Francisco, with moderated discussions (streamed in real time) exploring how computing has evolved and where the field is headed.

More information and registration for this event is available on the Turing Award 50 website, http://www.acm.org/turing-award-50.