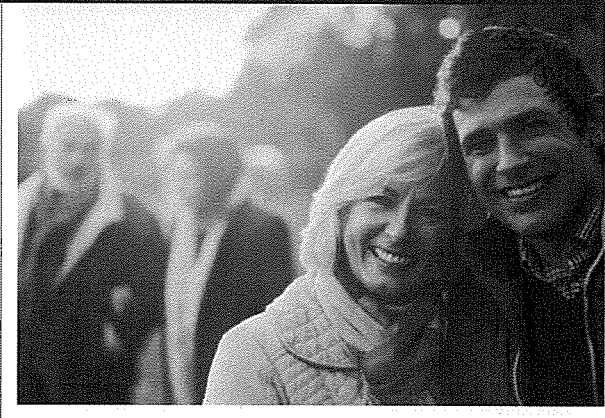


FOCUS: HEALTH CARE



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FOCUS ON INNOVATION

AHN, CMU partnership to reimagine health care

BY KRIS B. MAMULA
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Health insurer Highmark Inc. committed \$11 million to “invent the future” of health care less than a month after getting state regulatory approval to buy West Penn Allegheny Health System back in 2013.

Since then, researchers at Carnegie Mellon University and the newly branded Allegheny Health Network have been focusing on projects that could have an immediate impact on the cost and quality of health care. Two rounds of funding have occurred since June 2013, most with two-year awards of \$300,000, a small sum compared to other research institutions, said Alan Russell, who heads the research effort as director of CMU's Disruptive Health Technology Institute, which is housed within the university's College of Engineering.

“We're spending very precious resources and really laser-targeting them to problems that we, as a community, feel that have to be solved,” he said. “In each case, we're really targeting things that could be transformative for a patient, driving down costs and improving quality of life for patients.”

A research partnership between a big health insurer and prominent university is rare, Russell said, but it reflects Highmark's intention to fundamentally change the way health care is provided. Underway is work on a method to monitor how patients use medication inhalers, which are commonly misused, and the development of an anticancer drug.

“Many insurers have venture funds, but I don't think you'll see this kind of partnership,” Russell said. “It's a great relationship, based on trust.”

What follows are among the promising research projects that have received Highmark funding.

▶ ENHANCED COLONOSCOPY

YANG CAI AND DR. SHYAM THAKKAR

Co-principal investigators
Cai is senior systems scientist, CyLab; founder and director of Visual Intelligence Studio, Carnegie Mellon University School of Engineering; Thakkar is director of developmental endoscopy at Highmark Inc.'s Allegheny General Hospital and an adjunct professor of biomechanical engineering at CMU.



Thakkar

Colon cancer is the second-leading cause of cancer deaths, with 150,000 people being diagnosed and 51,000 dying from the disease annually. The disease develops from pre-cancerous lesions or polyps, which are simple to treat if caught early and many studies have found that colonoscopies are effective in catching and treating the disease.

“It's a very effective procedure in preventing cancer, but it's not 100 percent,” said Dr. Shyam Thakkar, a gastroenterologist. “The vast majority of the people with the disease will have no symptoms. We want to find out better what's going on, making colonoscopy more effective.”

The investigators' goal is to improve colonoscopy's effectiveness, which ranges between 76 percent and 90 percent. To do this, the research team is developing algorithms to analyze video feed that's part of the procedure.

Today, only snapshots of the procedure are saved for the patient's medical record. Researchers will use the video to develop algorithms for what the doctor sees during a colonoscopy, measuring the quality of the exam.

“We're creating a library to look at things we might not have been able to appreciate otherwise,” said Yang Cai. “It's very transformative work. Previously, you only had a snapshot. Now you have annotated video. ... This has tremendous value for training and also creating a new product.”

FOCUS: HEALTH CARE

▶ ANOMALY AND PATTERN DETECTION IN MEDICAL CLAIMS DATA

JEFF SCHNEIDER

Associate professor, Carnegie Mellon University School of Computer Science; co-founder with Artur Dabrowski of Automotive Systems Inc.



Schneider

Jeff Schneider's interest in applying the principles of machine learning to industry dates back to the days after the terrorist attacks of Sept. 11, 2001, when worries about an anthrax attack spurred biosurveillance research.

He received a grant at the time to find a method of screening hospital emergency department patients in a way that could signal a terrorist attack by checking for certain shared symptoms.

Now, he's applying the same bulk-screening technique to batches of health insurance claims, looking for variability that indicates fraud or simple errors in coding. Identifying things that are shared and stand out according to certain criteria can also identify untoward medical interactions that may not have been previously known.

Such an analysis can also identify the kinds of care that have the best results for patients. These tasks are done manually today by experts who are looking for specific issues or patterns.

Schneider is reluctant to talk specifics of what he's found sifting through a mountain of medical claims for Highmark Inc., but he has conferred with the insurer's fraud unit and identified some providers who were practicing "way outside the norms," he said.

"We're essentially the big-data project," Schneider said. "We feel like our software is quite close to commercialization."

"It's an area that I care a lot about."

▶ NEXT-GENERATION ECG AND MACHINE LEARNING SOFTWARE

DAVID STAGER

Principal Investigator; senior commercialization specialist, National Robotics Engineering Center, Carnegie Mellon University



Stager

Electronic devices to record the heartbeat have been around for a century, but the machines haven't changed much in recent years. Now, a research team from Allegheny General Hospital and Carnegie Mellon University have come up with a way to capture more information about the heart's tiny electrical impulses.

The researchers first adapted a sensitive device that is used to measure brain waves to record the heart's electrical activity. Instead of 12 leads that most heart monitors come equipped with, the team embedded 60 leads in a vest that is worn by the patient.

The vest is also equipped to capture the patient's pulse and blood pressure, giving doctors a bigger picture of what's happening inside the heart.

"We get a much broader perspective by enhancing the amount of information that's available," said Dr. Emerson Liu, an Allegheny General Hospital cardiologist who specializes in heart rhythms. "Beat-to-beat changes may become apparent."

The enhanced sensitivity of the test and machine-learning capabilities of the software will allow doctors to identify events that predict sudden changes in heart rhythm that could be life threatening. Sudden cardiac death, for example, kills up to 400,000 people annually and most often strikes without warning.

Testing with the vest could better identify which heart patients are at greatest risk for sudden cardiac death or other dangerous electrical malfunctions.

"We have one of the largest databases of electrophysiology records," said David Stager, the team's principal investigator. "There will be a lot of push-back and distrust to prove. It's a long road to prove that it's trustworthy."

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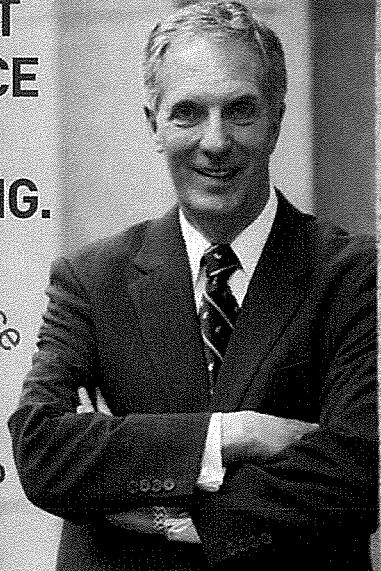
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