Array of Accomplishment

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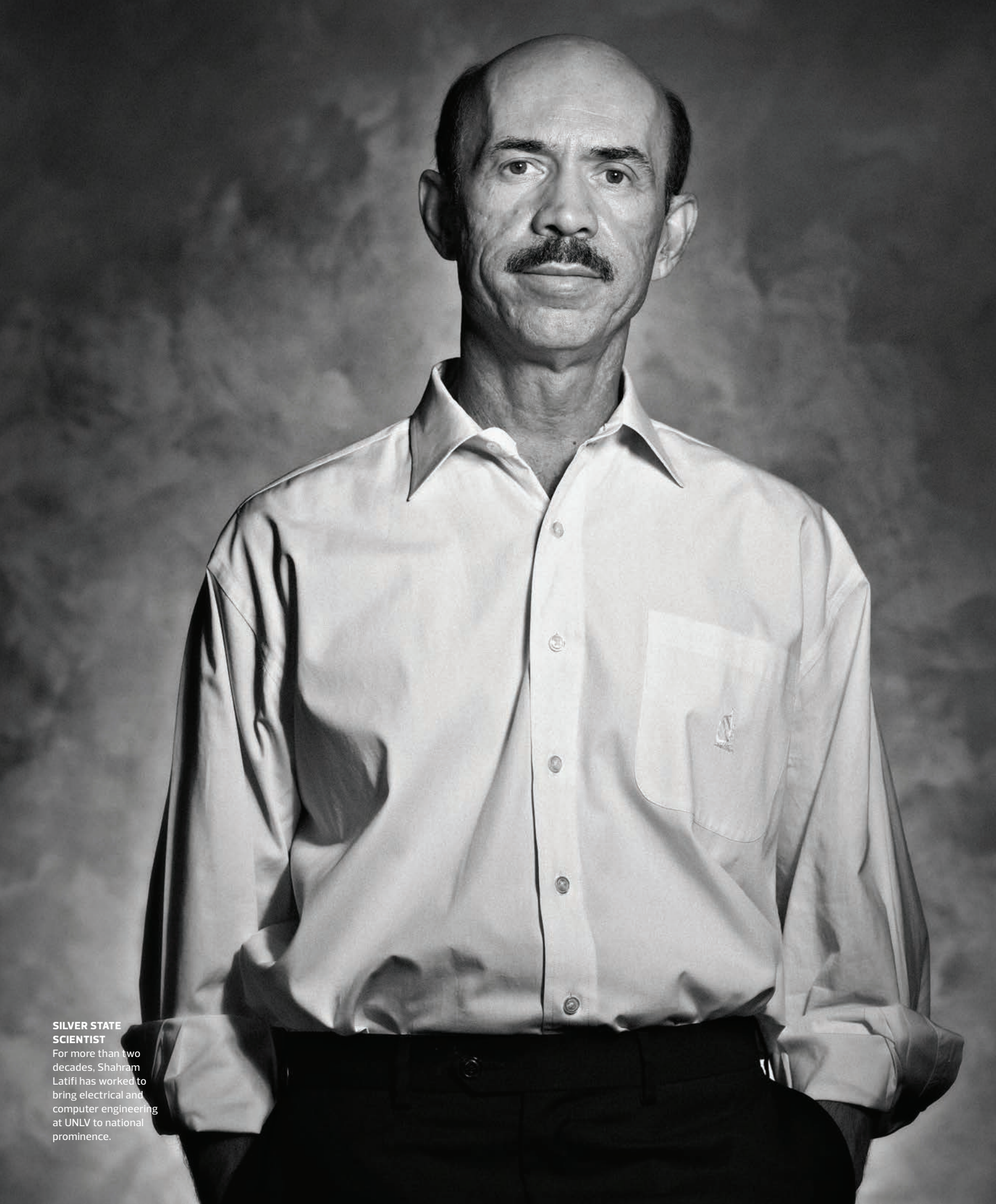

SILVER STATE SCIENTIST
For more than two decades, Shahram Latifi has worked to bring electrical and computer engineering at UNLV to national prominence.

Array of Accomplishment

In an era of specialization, **SHAHRAM LATIFI** has pursued a diversity of interests.

BY CHARLES E. REINEKE

Back in 2004, the Swiss-born philosopher and critic Alain de Botton penned a memorable phrase that rings especially true for engineers: "We delight in complexity," de Botton wrote, "to which genius has lent an appearance of simplicity."

Thus it is in the world of Shahram Latifi, a professor of electrical and computer engineering at UNLV, whose work explores how a dizzying array of his discipline's most complex areas — digital networks and data compression, parallel processing and distributed computing, advanced image processing and remote sensing — can be used to craft elegant solutions to problems fraught with complication.

As Bijan Salimi, a prominent Nevada engineer recently put it, "the depth and breadth of his knowledge in his field are truly remarkable." It's an assessment shared by many, including the committee of scholars that earlier this year conferred upon Latifi the 2014 Harry Reid Silver State Research Award. The award, UNLV's most prestigious research honor, singles out faculty members whose work achieves a rare trifecta of attainments: It significantly advances the recipient's academic field, addresses real-world needs and concerns, and contributes to Nevada's economic growth and development.

PHOTOGRAPHY BY AARON MAYES

LATIFI, WHO GREW UP IN IRAN, DISCOVered early on that math and engineering would be his calling. As a child he possessed a rare aptitude for numbers and problem solving. His parents — especially Latifi's dad, Reza — were thrilled and urged him to make the most of his gift.

He did. By the time he reached high school, Latifi was years ahead of his mathematics classmates. He was still a sophomore when he was chosen to join a delegation of students representing Iran in the International Math Olympiad competition, the annual "world championship" of numbers.

Latifi was introduced to engineering during his senior year. It immediately struck a chord. Since his pre-teen days, the budding scholar had long searched for an instrument to make math's abstractions more tangible. "It was the application of math that I was interested in," he says. "I wanted to use math as a means, not an end." Engineering fit the bill.

After graduation Latifi enrolled at Tehran University, then, as now, one of Iran's top destinations for math and engineering. Not long after he matriculated, however, the campus was roiled by student strikes and protests, a years-long outpouring of sometimes-violent discontent that preceded the fall of the Shah.

Latifi says he steered clear of politics, focusing instead on his coursework. This wasn't easy. The protests and related shutdowns sometimes made it impossible to complete classes. Finally, after two years of delays, Latifi graduated with a master's degree in electrical engineering in 1980.

Because Iran lacked institutions offering further advancement, the youthful engineer knew that progressing in his career meant moving on. In both physical and cultural terms, the locale he chose would turn out to be far afield indeed.

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THAT PLACE WAS LOUISIANA STATE University in Baton Rouge, La., the humid home of crawfish boil, étouffée, and an excellent engineering program. Latifi had never set foot on the campus before he arrived on an afternoon in mid-April. "It was very, very hot," he says, drawing in a deep breath as if reliving the sensation.

Despite the severely strained relations between the U.S and Iran, Latifi encountered no ill will. "I immediately interacted with people; they wanted to know my background, where I came from." he says. "Everyone was very friendly, very helpful."

At least, he adds, in so far as he could tell.

"The accent —the Southern accent — was something that was difficult for me to follow," says Latifi. "I had British teachers in Iran, and of course their accents were totally different."

When curious LSU students asked about his home country, for example, they almost always pronounced it, "EYE-ran." Latifi says he had no idea what they were talking about, but suspected it had something to do with the army. "I would tell them, no, I have never been in the army," he recalls with a laugh. "Of course, now when someone pronounces Iran as 'EYE-ran,' I understand."

If mastering the nuances of South-speak took time, the engineering curriculum was more yielding. Soon, Latifi was making important contributions to LSU's highly regarded computer engineering program. After completing a master's degree, he moved on to the doctoral program. His dissertation involved the design of computer networks composed of millions of processing elements.

"I started with computer networks for what we call massively parallel systems," Latifi says. "At that time we were looking for ways to help machines with tens of thousands of processing nodes act in harmony on very complex, computationally intensive problems."

Latifi examined interconnections among these nodes, discovering ways to make them execute these problems more efficiently. He found it enthralling work, even though it meant mastering a new set of skills.

"In Iran, my background was in power: high voltage electrical engineering. I was involved in designing anything from transformers to electrical machines — synchronous, asynchronous. I did a lot of projects in power generation, transmission and distribution. When I came to the United States I got interested in computer engineering. It was a totally different discipline."

Learning new sets of skills has become a hallmark of Latifi's career. He arrived at UNLV in 1989, convinced that the small but ambitious electrical and computer engineering department at the Howard R. Hughes College of Engineering would be a good place for him to pursue a variety of projects.

"It was a very young department. There were few faculty, but a lot of potential for growth," Latifi says. "That was one of the primary factors that led to my decision to come to UNLV."

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LIKE THE MOVE TO LSU, THIS ONE INvolved adapting to a new cultural milieu. It also meant he had some explaining to do, especially among professional colleagues who, like many Americans, often held an unapologetically myopic view of Latifi's new home.

"In the first few years I would get defensive any time I attended conferences — there was this stereotype about living in Las Vegas, that Las Vegas was all about hotels and casinos, nothing else," he says. "This was a motivating factor for me. However little it might be, I wanted to make a contribution to alter that perception — to show that, yes, we can have big projects coming out of UNLV, we can have very good quality students graduating from UNLV, and we can have professors who are internationally known working at UNLV."

One of Latifi's first successes arose from that "massively parallel" computing work he had pursued as a doctoral student. It remains among his most important contributions.

Early computers relied on what's called "serial computation" to get their work done, step-by-step sequences of instructions that could be completed by a single processor. In parallel computing, an array of processors work together on discrete aspects of problems far too complex for serially programed machines.

"Large" parallel systems are often made up of groups of separate computers working in tandem. "Massively" parallel systems, on the other hand, are typically single supercomputers with thousands of individual processing "nodes," each working in "parallel" and at blinding speed. UNLV's new Intel supercomputer is an example of such a massively parallel supercomputer; a scientist with a handheld calculator would need 159,000 years of non-stop calculating to match a single second of this supercomputer's activity.

In disciplines involving supercomputing — bioinformatics, weather forecasting, robotics, and artificial intelligence, just to name a few — massively parallel systems have revolutionized the way research is conducted. Latifi's work in the early 1990s helped make this possible.

"Soon after I came to Las Vegas I was able, for the first time, to propose a network with much better performance metrics than the existing ones, both in terms of solving highly parallel problems and computationally extensive problems, " Latifi says.

The 1991 paper resulting from that work has been described as a "milestone" that "opened up a new avenue of research." It has since been cited by scholars across the world.

Theorizing about ways to improve supercomputing did not limit Latifi's interest in more practical concerns. While still relatively new to UNLV, he served as a computer networking consultant for a local branch of the Lockheed Corporation and assisted a Las Vegas law firm investigating the circumstances surrounding the death of a man who may have been electrocuted.

Other consulting work followed, and Latifi has since continued to build bridges to the private sector, especially in developing technologies aimed at improving public health, safety, and security. His projects have included advancements in "partial iris recognition," systems that allow security screeners to identify malefactors who attempt to conceal their faces; next-generation unmanned aerial vehicles, a.k.a., drones, that will one day assist emergency-services personnel; and advanced image-processing algorithms, computer code that can make intelligible otherwise unreadable remotely sensed objects.

Latifi has also worked on a major data collection project aimed at assessing the pace of climate change, and has teamed up with NASA to think about ways of keeping deep-space astronauts in good trim. Not surprisingly, this latter project also involves a form of remote sensing.

When it's not possible to include a physician on a spacecraft, how, Latifi wanted to know, "can we efficiently monitor the astronauts?" The answer, he says, will likely involve creating better "cognitive systems," technologies that allow machines and people to interact more naturally. Such systems, he adds, will almost certainly produce benefits here on this planet.

"I'm working with my team to leverage this technology to deal with a very important problem right here, " Latifi says. "The population of elderly living in Nevada is high. How might we remotely monitor the health of these elderly in their homes? I've been striving with my team to come up with a lighter, more powerful, more patient-friendly [monitoring] system that is also more reliable — something that would immediately register a fall, a sudden drop in blood sugar, fluctuations in blood pressure, or any abnormality."

EMERGING ENGINEERS Latifi consults with master's student Steven Wilson (right) and undergraduate student Jeevake Attapattu (center).

This "something," he explains, will involve a series of sensors forming what engineers call a "body-area network" — a form-fitted, information-gathering grid that would use wireless, ultra-wideband technology, or UWB, to transmit vital signs and other data to health-care professionals in near real time.

"Our ultimate goal is to save lives, to prolong lives," he says.

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WHEN THESE AND OTHER RESEARCH interests are coupled with Latifi's long experience organizing information-technology conferences — events that for more than two decades have brought hundreds of prominent international scholars to Las Vegas and the UNLV campus — a picture emerges of a high-energy scholar whose interests and expertise defy the notion that today's academe is all about specialization.

Asked whether there might be a common thread binding together his extraordinarily diverse oeuvre, Latifi pauses for a moment. "That's a very good question," he says, then briefly describes how mathematics — his first love — has been a crucial component throughout his career.

"Apart from that, I was fortunate to have been exposed to different aspects of electrical engineering, from the traditional, high-voltage electrical work to the more modern computer engineering," he says. "This enabled me to tackle a variety of assignments that at the time seem to have nothing in common."

It's a breadth of knowledge that has made him both a popular instructor of undergraduates and an advisor and mentor to more advanced students. Awards like the Silver State Research prize are wonderful honors, Latifi acknowledges, but he says that his work with these engineers of the future will define his legacy.

"For years I've been recruiting quality students into our Ph.D. program, helping them do projects and write grant proposals with me. They've been very successful," he says. Latifi, a fellow of the prestigious Institute of Electrical and Electronics Engineers, has been a principal or co-principal investigator on 26 grants totaling over $38 million.

This is not to suggest, of course, that there's not also something to be gained by engaging more youthful minds. "I always bring to the undergraduates' classroom some of my project problems," Latifi says with a laugh. "This has two distinct benefits: At the same time the students get experience, I get my problems solved."

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