

# Chasing shadows: How AI can help cities beat the heat with shade

By Kelly deVos, ASU News  
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At the 2024 Paris Olympics, [marathoners pushed through miles](#) of scorching pavement while fans crammed into sun-soaked plazas and stadiums. More than a year later, [fans remember games](#) that were both fun and fashionable. But for event officials, the sobering challenge of [planning for extreme heat](#) remains.

Shade, it turns out, can be vital when the mercury rises. A shadow from a building can lower surface temperatures by 20 degrees Fahrenheit or more, offering life-saving relief. But knowing where shade will be and how to get there isn't always easy.

That's where [Hua Wei](#) and his team at Arizona State University believe artificial intelligence, or AI, can help.

Wei, an assistant professor of computer science and engineering in the [School of Computing and Augmented Intelligence](#), part of the [Ira A. Fulton Schools of Engineering](#) at ASU, has launched two complementary projects that use AI to make shade information practical, accessible and actionable.

One helps people choose cooler walking or biking routes in real time. The other uses generative AI to simulate how shade shifts through the day, providing data for city planners and designers. Together, the projects are part of Wei's broader mission: harnessing AI to support human-centered, smarter cities.

## Staying cool on the move

The first project, called Shaded Route Planning, was designed with people in mind, especially pedestrians and cyclists who face hours of sun exposure during heat waves. Traditional mapping apps prioritize speed or distance. Wei's tool adds a third factor: shade.

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The system starts by scanning satellite images to spot where shade falls from trees, buildings or other structures. It then lines that information up with maps of sidewalks and streets to figure out how much of each path is covered. From there, the tool gives users several options. They can take the fastest route, the shadiest route or strike a balance between the two.

The prototype was successfully tested at the Paris Olympics to help visitors choose cooler paths between venues. In a demo, the shortest route glowed orange across the map, cutting straight down sun-drenched boulevards. A slightly longer path appeared in green, winding through shaded alleys and tree-lined streets.

“Even a small change in the route can make a big difference,” Wei says. “It could mean fewer cases of heat exhaustion and a much more pleasant experience for thousands of travelers.”

(Video: {<https://www.youtube.com/watch?v=5Ctz1GK86Hs>})

## Seeing tomorrow's shadows today

While Shaded Route Planning helps people on the move, Wei's second project looks at the bigger picture. DeepShade is a generative AI system that predicts how shade appears and shifts in urban areas over time.

The problem is that regular satellite photos don't show shade very clearly. They may be out of date, grainy or taken inconsistently when shadows might look completely different. DeepShade fixes this by creating realistic “what-if” pictures of shadows throughout the day and across the seasons. It uses information about buildings and the sun's position to simulate how shade should fall. Those examples then teach an AI system how to generate detailed shade maps on demand. A user could ask the system to show, for example, what an area looks like at 6 p.m. in July, and it will draw the shadows exactly where they'd be.

To refine accuracy, the model uses edge detection to capture crisp building outlines and contrastive learning to ensure shadows evolve realistically over time. In experiments across 12 cities, from Beijing to Tempe, Arizona, DeepShade consistently outperformed other AI methods in generating accurate shade predictions.

In practice, this means city planners could use DeepShade to test how adding a row of trees, adjusting building height or placing a new bus stop might change shade availability for pedestrians. It provides a data-driven way to design “cool corridors” and public spaces that protect vulnerable populations during extreme heat.



*An animated graphic showing DeepShade in action. The system takes noisy satellite images and uses AI to generate realistic, high-resolution shade maps. Graphic courtesy of the Data Mining and Reinforcement Learning Group/ASU*

## **A researcher on the rise**

For Wei, these projects are part of a growing portfolio of work that blends technical AI expertise with real-world impact. His research on decision-making systems has already earned him a prestigious 2025 [National Science Foundation](#) Faculty Early Career Development Program, or [CAREER, Award](#), support from Amazon and collaborations with city governments.

He is particularly focused on what AI researchers call the “simulation-to-reality gap,” or the problem that algorithms often perform well in clean, simulated environments but stumble in messy, unpredictable real-world conditions. Shade, with its dependence on weather, season and urban form, is a perfect example of such complexity.

To tackle these challenges, Wei works closely with other leading researchers, including [Yezhou “YZ” Yang](#), a Fulton Schools associate professor of computer science and engineering. Yang is a thought leader in computer vision, making him an ideal collaborator for projects like DeepShade.

“For me, the promise of AI has always been about more than algorithms. It’s about creating tools that touch people’s lives in meaningful ways,” Yang says. “I’ve long believed that AI for social good means designing systems that don’t just push technology forward, but bring comfort, dignity and well-being to the communities we serve.”

## **Designing for people, not just systems**

At its heart, Wei’s work is about empowering people. As extreme heat becomes one of the world’s most pressing public health challenges, tools like Shaded Route Planning and DeepShade are more than technical experiments. They’re glimpses of how cities might adapt — not in abstract ways, but in the lived experience of a cyclist finding relief under tree cover, a tourist enjoying a cooler walk to an Olympic venue or a community planner deciding where to add the next stretch of greenery.

“We want AI to support decisions that people can feel in their daily lives,” Wei says. “When the sun is beating down, finding shade isn’t just about comfort. It’s about health and resilience.”

*This story originally appeared on [ASU News](#).*

## **Main image**



Hua Wei, a professor of computer science and engineering in the School of Computing and Augmented Intelligence, part of the Ira A. Fulton Schools of Engineering at Arizona State University, poses in front of a cityscape. He leads a research team developing artificial intelligence, or AI, tools that map, predict and plan for shade, helping people stay cooler and cities become more resilient. Photo by Erika Gronek/ASU