Complex legal arguments are nothing new, but Pitt professor Kevin Ashley is using a novel method to decipher them. He’s combining his expertise in law and computer science to help students explore the intricate logic of the nation’s highest court.

Supreme Decisions

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Photography by Jim Judkis

In San Diego, federal agents monitor a motor home that’s sitting, stationary, in a parking lot. They suspect illegal activity. Eventually, a teenage boy exits the motor home. The agents approach him, and he admits that he just bartered to receive marijuana, a violation of U.S. law. The agents tell the teen to return and knock on the door. When a man inside answers, one of the agents enters the motor home—without permission or a search warrant—and finds marijuana, plastic bags, and a scale for weighing drugs. Then the agents take the motor home to a nearby police station, where it’s searched for a second time, and more marijuana is found. The man, Charles Carney, is charged with possession and sale of marijuana.

Nearly three decades later, Pitt law student Corrine Saylor reads the tale of Carney’s misdeeds on a computer screen in the Barco Law Building’s computer lab. The crime story does not have a simple end, but that only makes Saylor’s task more interesting. She’s using a new method of digital study, developed at Pitt, to examine the legal system’s twists and turns.

Saylor is examining the Supreme Court case of *California vs. Carney* to inform her understanding of the Fourth Amendment of the Bill of Rights, which protects citizens against “unreasonable searches and seizures.” Usually, cases for marijuana peddling are decided quickly by local judges and aren’t heard in higher courts—but Carney’s case raised interesting legal questions because of the motor home, which isn’t a typical residence. His case was debated multiple California courts and ultimately argued in the U.S. Supreme Court in 1984.
O
n screen, Saylor reads a transcript of the Supreme Court oral debate when Carney's case was argued. She ponders some of the same questions that the justices considered: Is a motor home a vehicle or a residence? If it's a residence, were the federal agents wrong to search it without a warrant? Was Carney's privacy illegally invaded? Then she clicks on virtual buttons in a software program to map out an argument diagram showing how the justices evaluated those questions in considering their decision.

Saylor is learning from, and testing, a pilot computer program developed by the University of Pittsburgh's Kevin D. Ashley and colleagues. He's an expert at using computers to model how lawyers, judges, and other legal professionals ponder and interpret laws. A professor of both law and intelligent systems, as well as a senior scientist in the University's Learning Research and Development Center (LRDC), Ashley conducts hybrid research that involves the fields of law, learning, and artificial intelligence.

For more than 20 years, Ashley has been working in artificial intelligence—the branch of computer science that simulates intelligent behavior—to get computers to understand what goes on in the American judicial system. With his interest in law, he's in a unique position to help the computer science world achieve a seemingly far-off goal: To get a computer to understand human common sense. "The law is kind of midway between math and science," he says. "When confronted with less-structured common sense, artificial intelligence doesn't have a clue as to how to proceed, but in the law, there's a fair amount of structure. The appealing idea is to try to take advantage of that structure. Then, artificial intelligence has a fairly good idea of how to proceed and represent information and model inferences."

This year, Ashley traveled to conferences nationwide and abroad to report on the unusual computer software program developed by the research team that he leads—a project that's funded by the National Science Foundation. The experimental software, called Legal Argument Graph Observer (LARGO), helps users analyze decision-making in the oral arguments of Supreme Court cases like California vs. Carney. It has the potential not only to improve legal studies, but also to bring computers closer to understanding the less-obvious patterns in human common sense.

Some days, Ashley can be found leading a Socratic discussion with students in the law school; other days, he's in his LRDC research office with a red pen and a stack of LARGO documents. One afternoon in his research office, he explains that the U.S. Supreme Court is one of the most unusual judicial bodies in the world, and its inner workings can be a challenge to understand. That's one reason he developed the LARGO software program—to help law students follow and interpret complex Supreme Court debates. While talking, he gently reclines in a swivel chair near a window overlooking Oakland's urban hillside. He's polite and genial, the sort of professor inclined toward neckties and round glasses, and he keeps himself in shape by swimming. On his desk are printouts of diagrams that various students have drawn using LARGO. He's marked scores on them in red pen.

Ashley says a characteristic feature of the Supreme Court is that justices pose hypothetical questions to the attorneys who are arguing cases. As the highest court in the land, the Supreme Court is the ultimate authority on interpreting the U.S. Constitution and other laws. It must consider how its decisions affect the Constitution and the future decisions of judges across the nation. To properly evaluate cases for their future impact, the justices must ask hypothetical questions.

This method of hypothetical reasoning helps the justices test the effectiveness of their interpretations, as well as understand how their decisions could set precedents for lower-court judges. It also helps them build arguments in support of their final decisions. In California vs. Carney, for example, the justices pondered the residency status of a motor home parked at a campground instead of a parking lot, or the residency status of houseboats and truck trailers, to gauge how their decision would affect future legal cases that might deal with privacy issues at "ambiguous" residences.

Ashley notes that it can be difficult for law students, and even legal professionals, to understand the purpose of hypothetical questions or the structures of the arguments that are built through a series of hypothetical questions.

"Law professors are famous for not doing a lot of explaining about what is happening in an argument," Ashley says. "If a student makes a weak argument, the professor will illustrate the problem to the student by taking advantage of the weakness and coming back with a strong response." However, he says, students can benefit from close analysis of arguments, through activities like drawing maps of arguments' structures. "It's helpful to go 'meta' from time to time to explain examples so that students can reflect on what's happening." And his LARGO program helps users do just that—by applying the analytic power of computers to decipher the hypothetical reasoning used in Supreme Court cases.

When Saylor used LARGO in the Barco computer lab, she scrolled through the written transcript of the California vs. Carney debate on the left side of her screen and highlighted important words in the text. Then, on the right side of her screen, she clicked little boxes and wrote summaries of the rules that the lawyers had posed, like: "If a vehicle has wheels AND is capable of moving, THEN a search without a warrant is permitted." After that, she drew lines to connect the boxes to the hypothetical ideas that the justices posited. One such hypothetical considered whether a motor home hooked up to water and electricity at a campground could be searched without a warrant. Sometimes, Saylor got stuck. When she didn't know what to do next, she clicked an "Advice" button. The program provided hints and suggestions for improving her argument diagram, based on the coding that Ashley had developed for the software to understand the arguments.

Yet, deciphering hypothetical reasoning isn't only a challenge for students. It's a challenge for computers, too. In a 21st-century digital world, computers
seem to be all-knowing, and it's easy to forget that people have created the artificial intelligence programs that enable a personal computer to beat a chess master.

For his PhD dissertation in the late 1980s, Ashley wrote a computer program called HYPO that simulated both sides of a legal argument. It incorporated some hypothetical reasoning, though not nearly as advanced as today's LARGO. Still, it was innovative work, and his dissertation was ultimately published as *Modeling Legal Arguments: Reasoning with Cases and Hypotheticals* (MIT Press). But Ashley hasn't always mixed the fields of computer science and law.

"When I went to college in the '70s, to be interested in computer science meant that you had to write your programs on IBM punch cards, deliver a whole pile of them to the computer center, and then come back in the morning to discover you'd left a comma out someplace," he says, tossing his hands up. "It was a very frustrating activity. So, I wanted NO part of computers," he says, with amusement.

As an undergraduate, Ashley studied philosophy at Princeton and then earned a Harvard law degree. Afterward, he worked as a litigator at a high-profile New York law firm, where he was well paid but uninspired—there wasn't enough time to analyze intelligently the cases shoved across his desk. So he considered various career options and, because "computer law was a hot topic at the time," he enrolled at the University of Massachusetts to earn a master's degree in computer science. Once he discovered that he could model legal arguments with artificial intelligence—and didn't have to deal with punch cards—he decided to pursue a doctoral degree.

"Artificial intelligence was coming into its own when I was in graduate school," he says. "You could conceivably build a program that could work not just on one example of an argument, but on a bunch of other examples, too. You would look to see what kinds of examples it would start to break down on, and that's where you would try to improve, invent, and make new things. Artificial intelligence just fit my philosophical interests."

*California vs. Carney* was argued in the Supreme Court while Ashley was in graduate school, and he added the case to his PhD dissertation on HYPO, unaware that it would become a featured example in his future research.

Since joining Pitt's faculty in 1989, Ashley has written and evaluated several tutoring programs that are designed to help users understand different aspects of law. Typically, such programs have been developed to help philosophy students or others in liberal arts studies to understand the art of argument, but few of these programs focus on legal studies—and Ashley's programs are more interactive than most. Many, for instance, don't provide the "advice" feedback that students like Saylor receive when they get stuck. In recognition of his groundbreaking work, Ashley received the Pitt Chancellor's Distinguished Research Award in the Senior Scholar Category in 2000. That same year, he also served as president of the International Association for Artificial Intelligence and Law.

Ashley's most recent project, LARGO, has been creating a buzz. The maps on his desk are just a few of hundreds drawn by Pitt law students, including Saylor, who is now working with Ashley as a research assistant. "The program helped me to realize that the law could be approached by breaking things down into smaller problems," she says.

In addition to collecting anecdotal evidence about the effectiveness of LARGO as a teaching tool, Ashley also is analyzing its impact through various quantitative methods. He has, for instance, been comparing scores on the students' diagrams (marked in his red pen) to the students' scores on the LSAT, a standardized test that all law-school applicants must take. Some of his evidence shows that LARGO is very helpful as a learning tool for students with lower LSAT scores. Lately, he also has been busy giving conference talks in the United States and abroad. In his presentations, he uses the *California vs. Carney* case to explain how LARGO works.

In the future, Ashley expects to build a grading system so LARGO can evaluate the student mapping diagrams by itself. He also hopes to include aural recordings of the Supreme Court debates. Because court transcripts in LARGO don't note, for example, the amount of time that passes between a