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Viterbi Software on the Anti-Terror Beat at LAX

Research Moves from Ph.D. Thesis to Experimental Police Tool

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Security officials at Los Angeles Airport are experimenting with a system developed by USC Viterbi S Engineering computer scientists to make their operations harder for the bad guys to predict and defe

USC-developed ARMOR randomization system is aimed at making operations like this K9 units unpredictable for terrorists or smugglers.

USC Professor Milind Tambe, a specialist in artif intelligence, led a team of USC researchers in ap theory insights to systematically make it extreme observers to find any patterns or regularities in L security routines.

The result is a software package with a computer showing a blank schedule, with a button labeled Pressing the button produces a set of times and security forces to be, a schedule that produces th level overall coverage as conventional scheduling so unpredictably.

"To interrupt or deter a terrorist plot in the surveil is the safest and most efficient manner to protect said James Butts, director of law enforcement for Angeles airports, including LAX, Van Nuys, Palm Ontario. "This program and technology directly a

thwarting potential terrorists at the earliest stages of planning."

The initial impetus for the system came from Erroll Southers, a former FBI special agent who serves associate director for the Department of Homeland Security-funded Center for Risk and Economic Terrorism Events (CREATE). Southers said he "looked at the checkpoint situation at the airport," an was vulnerable. "That's how we came up with the project."

But the solution was not simple or obvious: it involved basic research in computer science applicatio theory. The USC system, called ARMOR, answers a challenge posed in a 2007 doctoral thesis by T student Praveen Paruchuri that is the mathematical heart of the new system, the bulit-in strategic ad enjoyed by terrorists. "For security, " Paruchuri wrote, "the police have to commit to a policy, while th adversaries may observe and exploit the policy committed to."

Complicating matters, the police face different types of adversaries, with different threats or aims; sm

terrorists— and
the strategy has to cope with all the threats in optimal
fashion. And the police force itself isn't a simple,
singular "decision" (to raise prices, for example) but
the activities of a host of individual agents working in a
large area, trying to counter an unknown number of
opposition agents.

The thesis, "Keeping the Adversary Guessing: Agent
Security by Policy Randomization," builds on a
mathematical business strategy developed for
commercial situations in which one company in a
competitive situation because of its size and
prominence has to essentially 'play first," known
formally by the formidable title of a "Bayesian-
Stackelberg game."

ARMOR interface randomizes operations without sacrific...

Paruchuri then used artificial intelligent agent techniques, in which computer programs are set up to
individual, cooperative roles in problem solving and, making simplifying assumptions, was able to cre
algorithm yet for solving this class of problems, for making the right first move an algorithm that was
Sarit Kraus, a professor of computer science at Bar-Ilan University in Ramat Gan, Israel, contributed
Paruchari's work, and USC assistant professor of systems engineering Fernando Ordoñez was instru
helping Praveen formulate the Bayesian Stackelberg game as an optimization problem, so it could b
efficiently.

Using his insights, Tambe, Ordonez and a team of graduate students -- Janusz Marecki, James Pita
Christopher Portway and Jonathan Pearce -- were able to create ARMOR, working with funding from

In April, the work was presented at LAX by Praveen "to a room full of police officers, and it was very
appreciated," Tambe continued.

"We then had a few meetings, visited with LAX and saw checkpoints in operation. Based on the inpu
provided we refined our system, and then did some initial program demonstrations to them in July; ir
suggested that we start
implementing our outputs, and they did."

Tambe emphasized that his team tailored the basic system directly to the
needs of LAX police, based upon their inputs. "I am overwhelmed by the
goodwill and spirit of collaboration of LAX police," he said. "I am really glad
that they are willing to take on new technology."

"I liked the concept," said Butts, "I approved of us being part of it. This
randomization technique allows us to maximize the impact of our
deployment."

Erroll Southers: ex-FBI spec...
now at CREATE suggested a...

CREATE's Southers emphasized that the office of Mayor Antonio Villaraigosa took a direct interest i
cooperation between the city and airport and CREATE in finding security solutions.

ARMOR can take the entire system, including resources available (officers, K9 units work and break
create a completely randomized schedule that will cover as completely as a conventional one, but w
efforts to predict it.

Paruchuri is the second of Tambe's 2007 Ph.D.
have his work used in homeland security applica
Nathan Schurr's PhD work w**as the basis of a s**

system to use as training tool for fire departr
emergency responders.

Commencement 2007: Professor Milind Tambe (rear, left) was the advisor for Praveen Paruchuri (front, right,) whose PhD thesis provided the theoretical basis of the ARMOR software.