



DEPARTMENT OF
COMPUTER SCIENCE

TEXAS TECH
Whitacre College of Engineering

Outracing Champion Gran Turismo Drivers with Deep Reinforcement Learning

Peter Stone, Ph.D.

University of Texas at Austin

Tuesday, February 25, 2025

3:30 p.m.

Zoom: <https://texastech.zoom.us/my/stas.tiomkin>

Meeting ID: 554 589 4586

Passcode: 12345

Abstract: Many potential applications of artificial intelligence involve making real-time decisions in physical systems while interacting with humans. Automobile racing represents an extreme example of these conditions; drivers must execute complex tactical maneuvers to pass or block opponents while operating their vehicles at their traction limits. Racing simulations, such as the PlayStation game Gran Turismo, faithfully reproduce the non-linear control challenges of real race cars while also encapsulating the complex multi-agent interactions. Here we describe how we trained agents for Gran Turismo that can compete with the world's best e-sports drivers. We combine state-of-the-art, model-free, deep reinforcement learning algorithms with mixed-scenario training to learn an integrated control policy that combines exceptional speed with impressive tactics. In addition, we construct a reward function that enables the agent to be competitive while adhering to racing's important, but under-specified, sportsmanship rules. We demonstrate the capabilities of our agent, Gran Turismo Sophy, by winning a head-to-head competition against four of the world's best Gran Turismo drivers. By describing how we trained championship-level racers, we demonstrate the possibilities and challenges of using these techniques to control complex dynamical systems in domains where agents must respect imprecisely defined human norms.

Bio: Dr. Peter Stone holds the Truchard Foundation Chair in Computer Science at the University of Texas at Austin. He is Associate Chair of the Computer Science Department, as well as Director of Texas Robotics. In 2013 he was awarded the University of Texas System Regents' Outstanding Teaching Award and in 2014 he was inducted into the UT Austin Academy of Distinguished Teachers, earning him the title of University Distinguished Teaching Professor. Professor Stone's research interests in Artificial Intelligence include machine learning (especially reinforcement learning), multiagent systems, and robotics. Professor Stone received his Ph.D in Computer Science in 1998 from Carnegie Mellon University. From 1999 to 2002 he was a Senior Technical Staff Member in the Artificial Intelligence Principles Research Department at AT&T Labs - Research. He is an Alfred P. Sloan Research Fellow, Guggenheim Fellow, AAAI Fellow, IEEE Fellow, AAAS Fellow, ACM Fellow, Fulbright Scholar, and 2004 ONR Young Investigator. In 2007 he received the prestigious IJCAI Computers and Thought Award, given biannually to the top AI researcher under the age of 35, and in 2016 he was awarded the ACM/SIGAI Autonomous Agents Research Award. Professor Stone co-founded Cogitai, Inc., a startup company focused on continual learning, in 2015, and currently serves as Chief Scientist of Sony AI.

