Lessons Learned for AI Applications from the Autonomous Sciencecraft

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Abstract

In 2001 we proposed flying experimental software onboard an Air Force satellite constellation of three (3) spacecraft: Techsat-21 [Chien et al. 2002].

Three years later, in 2004, we were instead flying software onboard NASA's Earth Observing One (EO-1) mission as the primary operations path [Chien et al 2005]. This software documented over 10x increase in science return for the mission and a > $1M/yr in cost reductions.

Seven years later, in 2008, we have flown advanced AI software on 5 spacecraft: including the Mars Exploration Rovers Spirit and Opportunity on the surface of Mars [Castano et al. 2007, Chien et al. 2008]; and have linked together scores of Earth Observing assets in a space, air, in-situ sensorweb [Chien et al. 2005, 2008] all using AI software.

How did this all happen? What worked? What didn't work? If we were to do it all over again what would we do differently? In this talk I'll cover a range of topics.

First, I'll discuss why flying software (not to mention software that actually makes decisions!) on spacecraft is hard.

Next I'll discuss some of the interesting challenges and experiences we faced on EO-1.

Finally, I'll talk about current efforts to link together scores of assets autonomously using the internet to develop an Earth Observing Sensorweb.

Dr. Steve Chien is a Principal Computer Scientist at the Jet Propulsion Laboratory, California Institute of Technology where he leads efforts in autonomous systems. He holds a B.S. with Highest Honors in Computer Science, with minors in Mathematics and Economics, M.S., and Ph.D. degrees in Computer Science, all from the University of Illinois.

Dr. Chien is a recipient of over 100 technical awards from NASA. He was a recipient of the 1995 Lew Allen Award for Excellence, JPL's highest award recognizing outstanding technical achievements by JPL personnel in the early years of their careers. He has received NASA Medals for his work in autonomous systems in 1997, 2000, and 2006. He is a three time honoree in the NASA Software of the Year competition, most recently as the team lead for the Autonomous Sciencecraft Experiment which was a co-winner of the 2005 NASA Software of the Year Award. is an example abstract. It goes here in 9 point Times Roman type.

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