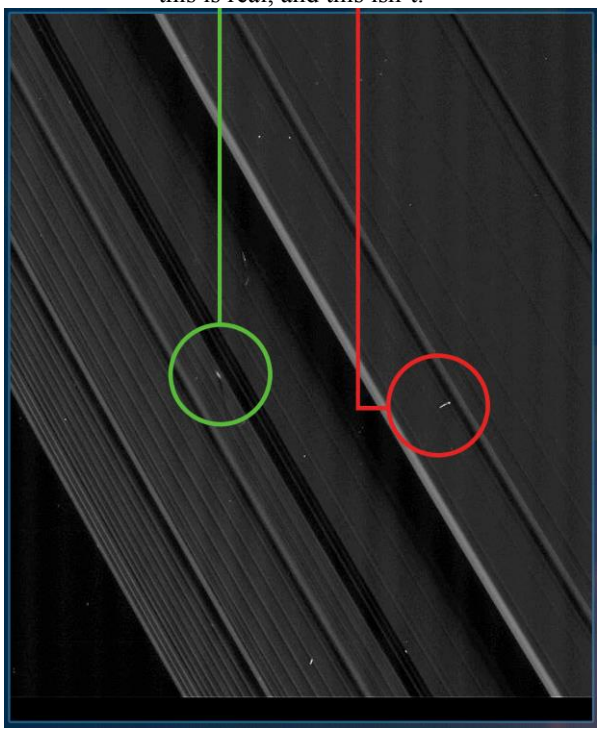
PDS and NASA Tournament Laboratory Engaging Developers: The Rings Challenge. M. K. Gordon[1], M.R. Showalter[2], J. Odess[3], A. Del Villar[3], A. LaMora[3], J. Paik[4], K. Lakhani[4],R. Sergeev[4], K. Erickson[5], C. Galica[6], E. Grayzeck[7], T. Morgan[7], W. Knopf [5], [1]Carl Sagan Center, SETI Institute, Mountain View, CA (mgordon@seti.org), [2]Carl Sagan Center, SETI Institute, Mountain View, CA (mshowalter@seti.org), [3] Appirio Inc, Powered by Topcoder, [4] Crowd Innovation Lab/NASA Tournament Lab at Harvard University, [5] NASA Headquarters, [6] NASA Tournament Lab, [7]NASA Goddard Space Flight Center.

Introduction: The Planetary Data System (PDS), working with the NASA Tournament Lab (NTL), Crowd Innovation Lab at Harvard University, and the Topcoder community at Appirio, Inc, is using challenge-based competition to generate new applications that increase both access to planetary data and discoverability—allowing users to "mine" data, and thus, to make new discoveries from data already "on the ground".

The Rings Challenge is one such set of competitions employing crowd sourcing and machine learning to develop a set of algorithms to identify persistent, non-axisymmetric features in the rings of Saturn.

THE RINGS CHALLENGE

Teach a computer that
this is real, and this isn't.



How Hard Can It Be? Previously, Topcoder ran a similar contest: develop an algorithm to be used against Earth observation satellite images of Mongolia in an attempt to distinguish ancient from modern structure in order to identify the site of the grave of Genghis Khan, with promising results. There were three major differences between the contests. 1) The area of Mongolia is 604,246 square miles; the surface area of Saturn's rings is 44,710,000,000 square miles. 2) Landmarks in Mongolia (e.g., mountains, cities) do not change their relative locations; in the rings every particle is on its own orbit; everything changes, all the time. 3) For the Mongolia project, Topcoder was able to use approximately 10,000 annotated images as a base set for machine learning; for the rings challenge, the annotated base set contained about 800 images.

Organization of the Challenge: The Challenge was tackled by running a series of separate contests to solve individual tasks prior to the major machine learning challenge. Each contest was comprised of a set of requirements, a timeline, one or more prizes, and other incentives, and was posted by Appirio to the Topcoder Community. The Community is comprised of over 750,000 multinational software designers, developers, and data scientists. Community participation is free for members and the contests were unrestricted; no academic or experience qualifications were required. Contest solutions were selected from submissions according to objective score. In the case of the machine learning challenge (a "Marathon Challenge" on the Topcoder platform), members competed against each other by submitting solutions that are scored in real time and posted to a public leaderboard by a scoring algorithm developed by Appirio for this contest.

The Marathon Challenge resulted in four highly competitive, but less than satisfactory solutions. A subsequent contest was then run to refine the best solutions.

Participation in the Challenge: NASA and space related challenges elicit a strong response from the Topcoder community as they provide citizen scientists opportunities to contribute to space missions that are normally inaccessible to them.

Participation	
Total Prizes/Incentives	$47,637
Total Contests	11
Total Registrants	266
Countries Rep'd	40
Unique Solvers	22
Unique Winners:	8

Results: After more than a year of refining objectives, identifying constraints, and executing ten sequential contests, the final contest is underway. The refined winning algorithms will be run against the approximately 30,000 highest resolution images of the rings obtained by Cassini.

We will report on the details of the challenge and its contests, and the result of that final validation.