WELCOME TO THE NASA TOURNAMENT LAB

NASA Tournament Lab

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But why?

It is impossible to "own" all the experts
Cost prohibitive / Scaling / Effectiveness

Joy's Law

"No Matter Who You Are, Most of the Smartest People Work for Someone Else"

- Bill Joy, Cofounder Sun Microsystems

The Causal Explanation for Joy's Law

- Knowledge is unevenly distributed in society - Fredrich von Hayek (1945)
- Knowledge is sticky - Eric von Hippel (1994)

Today's Knowledge and Information era requires a shift in traditional strategies and philosophies – Extensions to our Network are required

What is NASA Tournament Lab?

Operational Virtual Facility developed between NASA, Harvard, and TopCoder

Two Objectives –

1 Create novel, high quality working software for algorithmic / computational Challenges

2 Contribute towards the development of empirically validated science of innovation tournaments

Utilize the principles of distributed innovation to allow participants worldwide to <u>contribute</u> to solving mission challenges by developing innovative computational algorithms.

Investigating Various Design Parameters for Tournaments

Competition

Incentives

Problem Types

Information Sharing

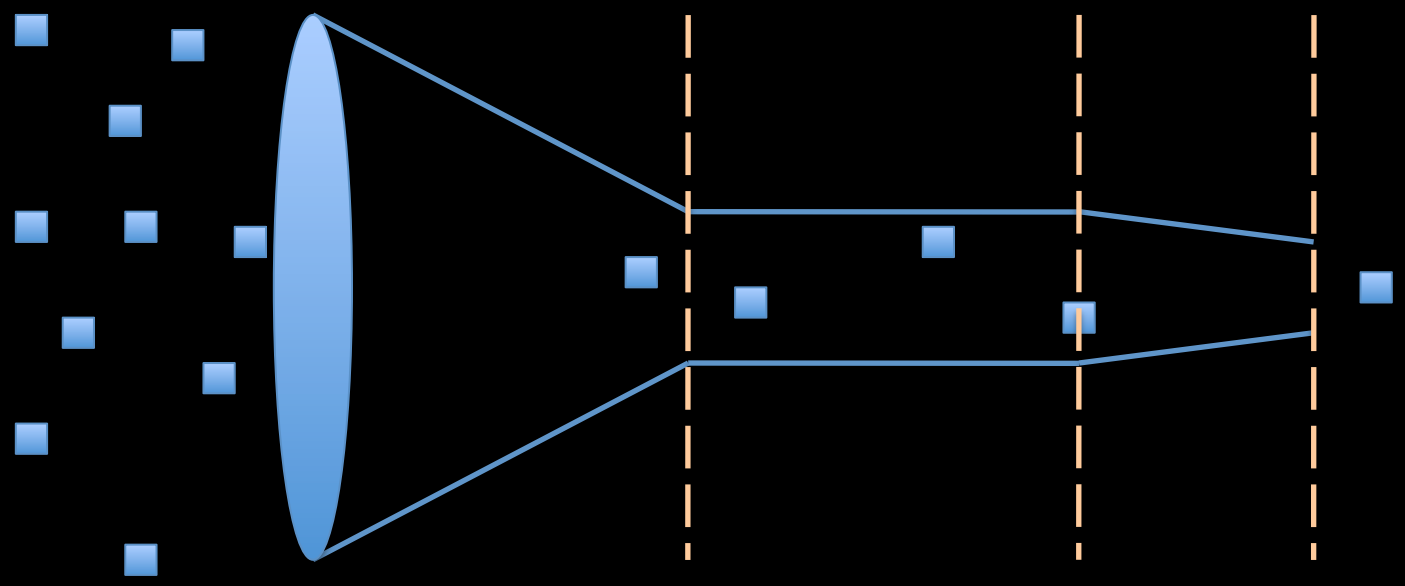
Collaboration

Team Design

Team Structure

Team Selection

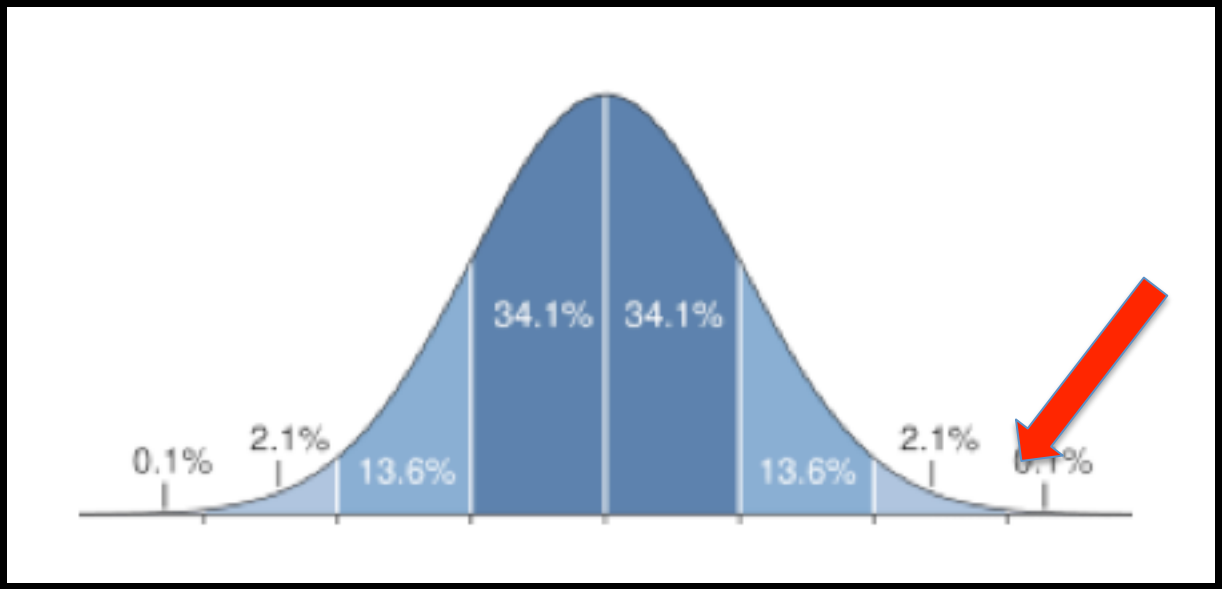
Traditional View of Solution Pipeline



Increase of ideas increase the chance of success
Problem though – how many ideas can you fund at each stage?

Driving to the extreme value solution

Problem – Extreme value probability is tied to number of ideas?



Sign-in to Portal

NASA Tournament Lab

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NASA Tournament Lab (NTL)

HOME | ABOUT | HOW TO COMPETE | NASA | FORUMS | RESEARCH PORTAL

WELCOME TO THE NASA TOURNAMENT LAB

NASA, Harvard Business School, and TopCoder have established the NASA Tournament Lab (NTL), which will enable the TopCoder community to compete amongst each other to create the most innovative, most efficient, and most optimized solutions for specific, real-world challenges being faced by NASA researchers.

› read more

HOW TO COMPETE

Where to compete, how to register, and much more!

RESEARCH PORTAL

NASA researchers, sign in here!

Leaderboard

Handle	Points
byronknoll	1
cannab	1
jagdish.vasani	1
parashurama	1
rado42	1
redquark	1
TheKingOfWrong	1
yowa	1

LATEST NEWS

JAN 28

The idea behind the first NTL marathon match challenge

posted by **NASA_Terry** on January 28, 2011 at 4:19 pm

The first NASA Tournament Lab challenge directly addresses NASA's on-going work to detect and classify features of scientific and humanitarian interest. NASA is interested in automatically processing remote sensing (aerial and satellite) data for a variety of reasons: there is increasingly too much data to deal with manually; there is a need to extract information from data in real-time; and there is an ever growing backlog of archived data waiting to be analyzed.

NASA has collected more scientific information about our planet and solar system than any entity in the history of humanity. The Mars Reconnaissance Orbiter alone

Active NTL Contests

NASA NTL - Marathon Match 1 $10000

More Details | Register | Discuss

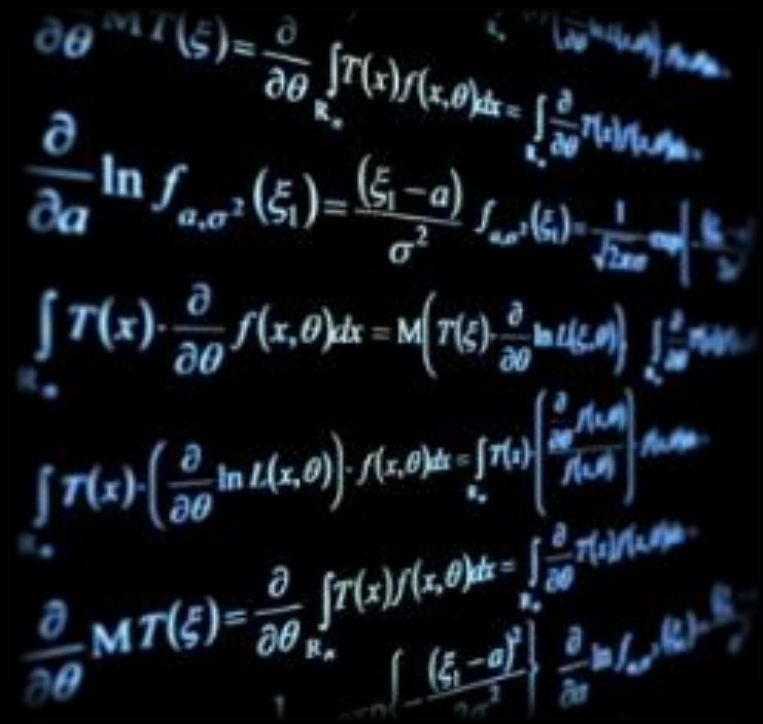
News and Announcements

- The idea behind the first NTL marathon match challenge
  by NASA_Terry on 01/28/2011 (4:19 pm)
- Welcome to the NTL
  by mike on 01/26/2011 (7:18 pm)

View All

Algorithm Competitions

Leverage Competition to Optimize
Complex Algorithmic Problems



Medical Kits… In Space

- Given potential medical supplies construct an optimal medical kit
  - Minimize the risk of mission evacuation from a bad health outcome
  - Minimize both weight and volume
  - Each medical supply has additional properties to consider
    - Reusability
    - Effectiveness on range of possible medical events and conditions

- NASA provided simulated medical event data from previous research
- Allowed for accurate evaluation of computed medical kits

Medical Kits… In Space

- Competition ran for 10 days
- 439 total contest participants
- 5,994 code submissions
- Cash prizes and 6 VIP Shuttle launch passes given out
- Winning solution performs kit optimization in 30 seconds, compared to 3 hours for NASA's previous best known solution (***360X***) improvement.
- NASA researchers "blown away" with the results
- Winning algorithm "works like a dream" in its use to redesign the medical kits used in space missions.

Pipeline Threat Recognition

- Detection and classification of objects in aerial images
- Algorithmically locate aerial images that contain potential pipeline “threats”
- Each image needs to be tagged with a threat confidence level
- Solutions must efficiently process tens of thousands of raw images

Potential Research Benefits:

- Planetary satellite imagery classification
- Federal disaster response and recovery
- Processing remote sensing satellite data

Example Challenge

Pipeline Threat Recognition

- Competition lasted three weeks
- 1,478 members registered to participate
- 549 total code submissions were performe
- NASA was very impressed with the top submissions which used “state of the art computer vision approaches”
- NASA identified 3 novel and distinct algorithmic techniques across the various top performers
- Active testing and integration of new ideas and techniques

Crater Detection

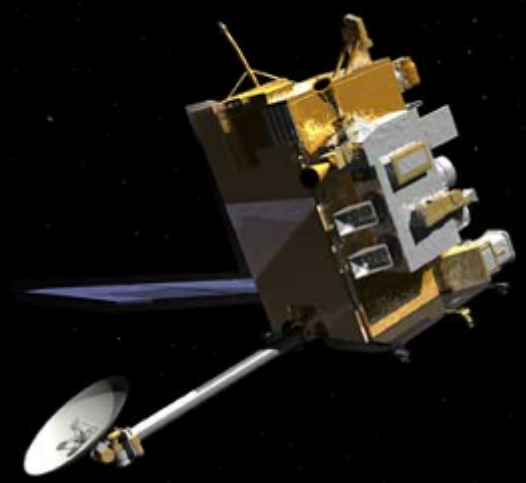
- Algorithmic detection of impact craters in lunar orbital images
- More effectively process the ever increasing amounts of orbital imagery of the Moon, Mars and other planetary bodies
- Competitor solutions provide coordinates of detected craters

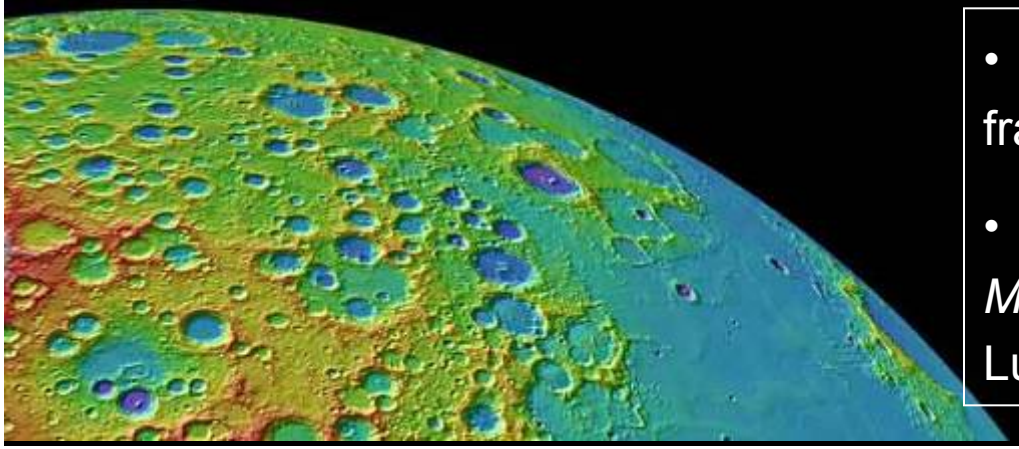
Potential Research Benefits:

- Planet formation and geology studies
- Align disparate data sets (radar, laser altimetry, etc.)
- Lander/Rover navigation planning

Crater Detection

- Two week long competition
- $10,000 in total prizes
- 1,174 competition registrants
- 310 unique submitters
- 8.63 submissions (on average) per competitor

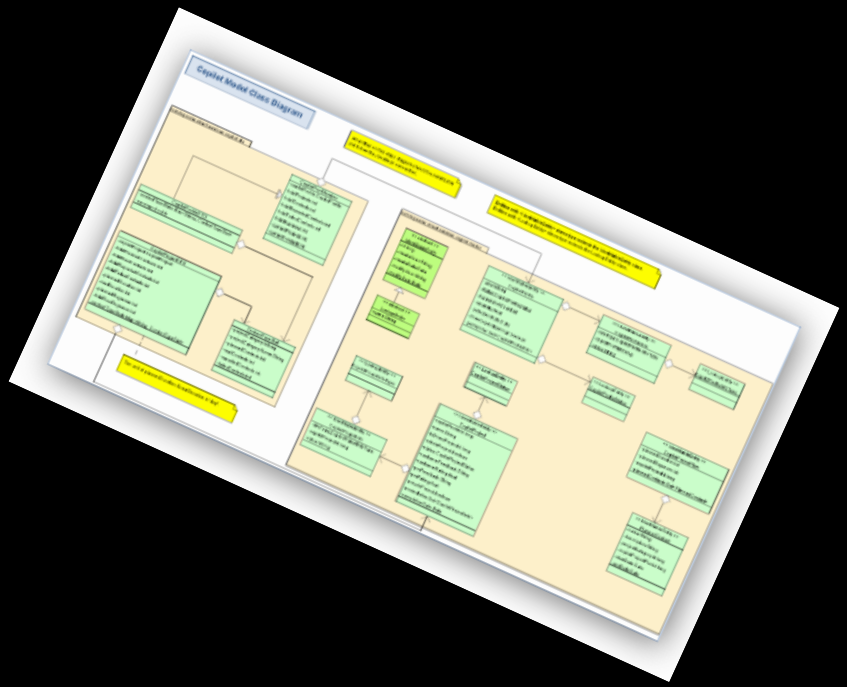


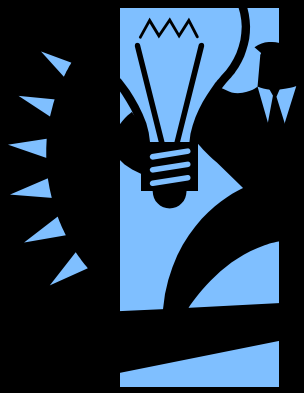


- *Integration* of final results into NASA framework is in-progress
- Winning algorithms to be shared with *Moon Zoo project* – a crowd-sourced Lunar imagery classification project

Beyond Algorithms

Competitive Application Build Process





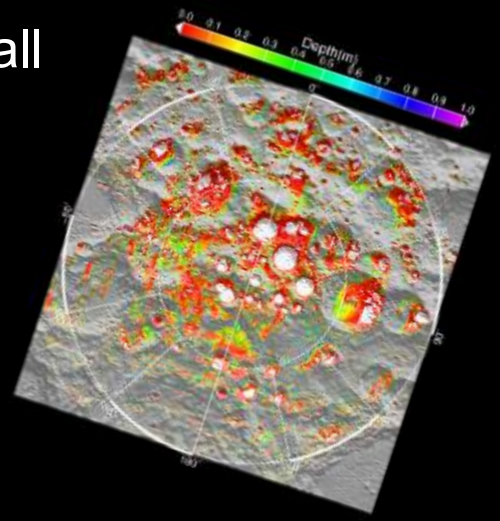
- Ideation
- Site Design
- Conceptualization
- Architecture
- Software Design and Dev

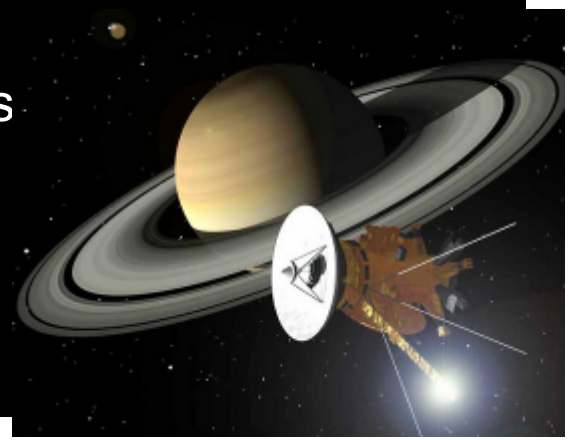
Portable Electrocardiogram App

- Create a mobile, Android-based 12-lead ECG data viewer
- Advance cheap, mobile medical applications
- Implications for both space medicine and for third-world countries
- Utilize range of competition types for full application build

Planetary Data Accessibility

- Planetary Data Systems (PDS) captures data from all space vehicles
  - Orbiters
  - Landers
  - Rovers
- Make Planetary Data Systems (PDS) information more easily accessible and interesting to the public
- Leverage competitive ideation process for generating new concepts
- Leverage competitive software development contests for building new ideas
- Architecture contests for data reorganization to achieve accessibility





Additional Examples of Challenges in Formulation

- 3D Human Factors Modeling
- International Space Station – Solar Array Optimization
- International Space Station – Trajectory Optimization

- HHS/CMS ERP Software
- USPTO Patent Examiner Image Annotation Tool

Center of Excellence for Collaborative Innovation

- Officially forming Center of Excellence for Collaborative Innovation November 1, 2011
- Organized to:
  - Provide Education, Community of Practice community, pilot infrastructure, and empirical measurement
- Located in the Human Exploration and Operations Mission Directorate (HEOMD) but serving NASA and the U.S. Government as a whole
  - Staffed by NASA and Contractor Personnel
  - Will include strong participation by other Agencies
- Serve as a convening point for all federal agencies; opportunity to expand into public-private partnerships

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