Creating a Program in MatLab to Classify CRISM Data

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ABSTRACT

The 2009-2010 undergrad Research team primary focus was to create a program using map lab that will classify CRISM data in a shorter time frame than what it will take to classify by hand. The CRISM research consisted of manually classifying images from Mars and placing them into excel's data base, downloading images and storing them into Kitoto's server so that the program can read and return results of the overall images and mineral images. These images can be classified as excellent, fair, poor, and absent. The classification of each image will show whether there is a lot, little, or no water in each kind of mineral. The five minerals are oxidized iron minerals. mafic mineralogy, hydroxylated silicates, bound water and CO2 water. The images that show the most signs of water in certain areas on Martian will be examined more closely. Currently, the CRISM team working is on creating this program in MatLab.

Frequently asked questions about Mars

- Is Mars environments suitable for life?
- If water was once present on Mars did it leave any clues"?
- If there was water on Mars, how did it affect Mars Surface?
- Can there be human exploration and colonization on Mars?
- How is Mars atmosphere different from Earths?
- When and where did the water occur?

Purpose

The Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) is one of NASA's high-tech Detectives seeking traces of past and present water on Martian surface." CRISM uses the saying "Follow the water" which is a method used for tracing and studying minerals that indicate liquid. By using this method of studying minerals in search for water, CRISM will be able to answer questions that many have been asking for years.

Note: Mars' liquid water may evaporate but that does not mean that it disappears. CRISM is still able to trace minerals such as iron Oxides, carbonates, Sulfates and other minerals on Mars.

CRISM Four Goals

- Find the spectral finger prints of minerals that form in liquid water.
- Measure the changing amounts of water and other volatiles in the atmosphere and as polar ices.
- Map geology, composition and layering of the surface features.
- Help locate Martian resources that could provide local support for eventual human exploration and colonization.

Common Thread	"Follow the Water"	
W	Determine if Life ever Arose on Mar	rs
A T	Characterize the Climate of Mars	al and a second s
E R	Characterize the Geology of Mars	
When Where Form Amount	Prepare for Human Exploration	A

Mentor: Dr Eric Akers

CRISM

- scannable field of view.
- Is a Visible-infrared imaging spectrometer with a
- Covers wave lengths from 0.362 to 3.92 microns at 6.55 nanometer/channel



oGimbal

- a feedback loop
- Data Processing Unit (DPU)
 - •Accepts and processes commands from the spacecraft





Undergraduate Research Experience CRISM Team 2009-2010

• This allows CRISM team to identify a broad range of minerals on the Martian surface.

CRISM Consist of Three Boxes

- Optical Sensor Unit (OSU)
 - •The optics,
 - •Focal planes
 - •Cryocoolers
 - Radiators
 - •Focal plane electronics
- Gimbal Motor Electronics (GME)
 - •Commands and powers the gimbal
 - •Analyzes data from angular position encoder in
 - •Accepts and processes data from the OSU and Communicates it to the spacecraft

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absent, ir_ice is absent	COORD Target - 4462 Alluvial Fan in Crater	FRT	http://crism-map.jhuapl.edu/summary.php?obs=FRT00007
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t, ir_ice is absent	S. Polar Monitoring - The Forks T1	FRT	http://crism-map.jhuapl.edu/summary.php?obs=FRT00007
ice is absent	THEMIS-VIS Greatest Hits (ID: 09695011)	FRT	http://crism-map.jhuapl.edu/summary.php?obs=FRT00007
absent, ir_ice is absent	Fill - Atmospheric EPF - 5084a 2 1256281 (TOO: High southern latitude)	FRT	http://crism-map.jhuapl.edu/summary.php?obs=FRT00007
t, ir_ice is absent	Pavonis Mons eastern summit region	FRT	http://crism-map.jhuapl.edu/summary.php?obs=FRT00007
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ir, ir ice is absent	COORD Target - Monitor changes in Richardson dune field	FRT	http://crism-map.jhuapl.edu/summary.php?obs=FRT00007
osent, ir ice is absent	Fill - Atmospheric EPF - 5088a 5 1256200 (TOO: Catina)	FRT	http://crism-map.jhuapl.edu/summary.php?obs=FRT00007
ice is absent	COORD Target - 11451 Basal Exposure of South Polar Layered Deposits	FRT	http://crism-map.jhuapl.edu/summary.php?obs=FRT00007
poor, ir_ice is absent	COORD Target - 360 Sample Tyrrhena Dorsa	FRT	http://crism-map.jhuapl.edu/summary.php?obs=FRT00007
is fair, ir_ice is absent	Fill - Atmospheric EPF - 5092a 5 1256121 (TOO: SSR)	FRT	http://crism-map.jhuapl.edu/summary.php?obs=FRT00007
oor, ir_ice is absent	Sisyphi Montes peak - possible ancient small highlands volcano	FRT	http://crism-map.jhuapl.edu/summary.php?obs=FRT00007
poor, ir_ice is absent	THEMIS-VIS Greatest Hits (ID: 06317005)	FRT	http://crism-map.jhuapl.edu/summary.php?obs=FRT00007
ellent, ir_ice is absent	7073 Light-toned layering on plains to the south of West Candor	FRT	http://crism-map.jhuapl.edu/summary.php?obs=FRT00007
ir_ice is absent	THEMIS-VIS Greatest Hits (ID: 15831005)	FRT	http://crism-map.jhuapl.edu/summary.php?obs=FRT00007
/d is fair, ir_ice is absent	13064 Sample south wall of Olympus Mons Caldera	FRT	http://crism-map.jhuapl.edu/summary.php?obs=FRT00007
ent, ir ice is absent	Tader Valles	HRL	http://crism-map.jhuapl.edu/summary.php?obs=HRL00007
ellent, ir ice is excellent	Fill - Atmospheric EPF - 5100d 1 1256220 (TOO: SPRC trough)	FRT	http://crism-map.jhuapl.edu/summary.php?obs=FRT00007
osent, ir ice is absent	Fill - Atmospheric EPF - 5100a 2 1256221 (TOO: High Southern Latitude;	FRT	http://crism-map.jhuapl.edu/summary.php?obs=FRT00007
osent, ir ice is absent	Fill - Atmospheric EPF - 5100a 3 1256222 (TOO: SSR)	FRT	http://crism-map.jhuapl.edu/summary.php?obs=FRT00007
r, ir_ice is absent	COORD Target - 11463 Basal exposure of south polar layered deposits	FRT	http://crism-map.jhuapl.edu/summary.php?obs=FRT00007

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Classification

Excellent Fair Poor Absent



Excellent Fair Poor Absent



Classifying Images (Minerals) Each Image has a IR Derived Product:

- Vnir-fem Oxidized Iorn minerals
- Ir maf Mafic mineralogy
- Ir_phy Hydroxylated Silicates
- Ir hyd Bound water
- Ir ice
- Water and CO2 Ice

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Classification





Water and CO2 Ice If all five minerals have something present other than "Absent" then the closer scientists are to finding answers regarding Mars

Downloading Images

- Click on a link
- Guide you to the webpage
- Enlarge the picture
- Save it to a destination
- Repeat steps

Moving Images Into Kitoto Directory of saved pictures

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Excellent Fair Poor Absent





Future Research

- Create a program that will read the files from Kitoto and classify CRISM images automatically instead of being done by hand.
- The data that we have classified will be sent to CRISM Researchers and NASA to use in future research to understand Mars atmosphere, where and when did the water on Mars occur, if Mars is suitable for life and if there can be human exploration on Mars.



Logging into Kitoto

sch	
3311	
ast login: Mon Mar 2	9 13:48:08 on ttys000
lan111–06m:~ Guest\$ s	sh jdeloatch@kitoto.ecsu.edu
deloatch@kitoto.ecsu	.edu's password:
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an111–06m:~ Guest\$ s	sh –Y jdeloatch@kitoto.ecsu.edu
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/ arnina: No xauth dat	a; using fake authentication data for X11 forwarding.
ast Login. Tue Mar	2 17.30.14 2010 from 10 24 61 189

- •Change directory to home
- •List all files in that directory
- •Change directory to crism
- •List files in crism

a) 30130, PHYLI
a) 30131, FEMLI
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a) 30131, JCELI
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a) 30144, JCELI
a) 30144, JCELI
a) 30144, JFMLI
a) 30244, FEMLI
a) 30234, FEMLI
a) 30234, JCELI
a) 30234, JCELI
a) 30234, JCELI
a) 30234, JFMLI
a) 30234, JFMLI
a) 30238, JCELI
a) 30241, FEMLI
a) 30241, FEMLI
a) 30241, JCELI
a) 30251, FEMLI

•List files in images

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