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.
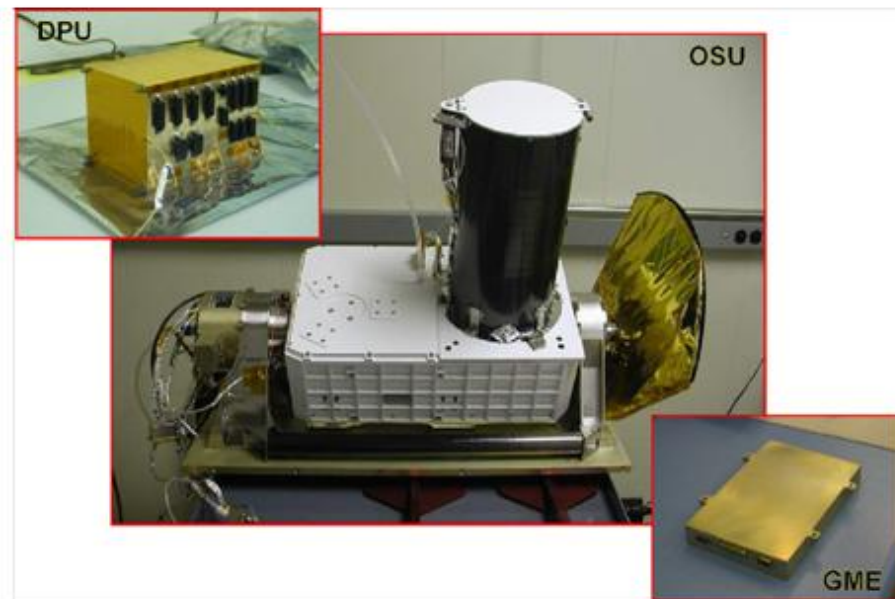

"Follow the Water"

CRISM

• Is a Visible-infrared imaging spectrometer with a scannable field of view.
• Covers wave lengths from 0.362 to 3.92 microns at 6.55 nanometer/channel .
• This allows CRISM team to identify a broad range of minerals on the Martian surface.
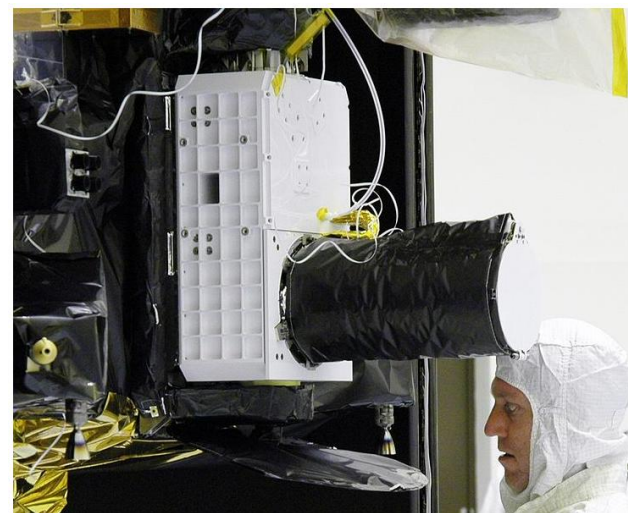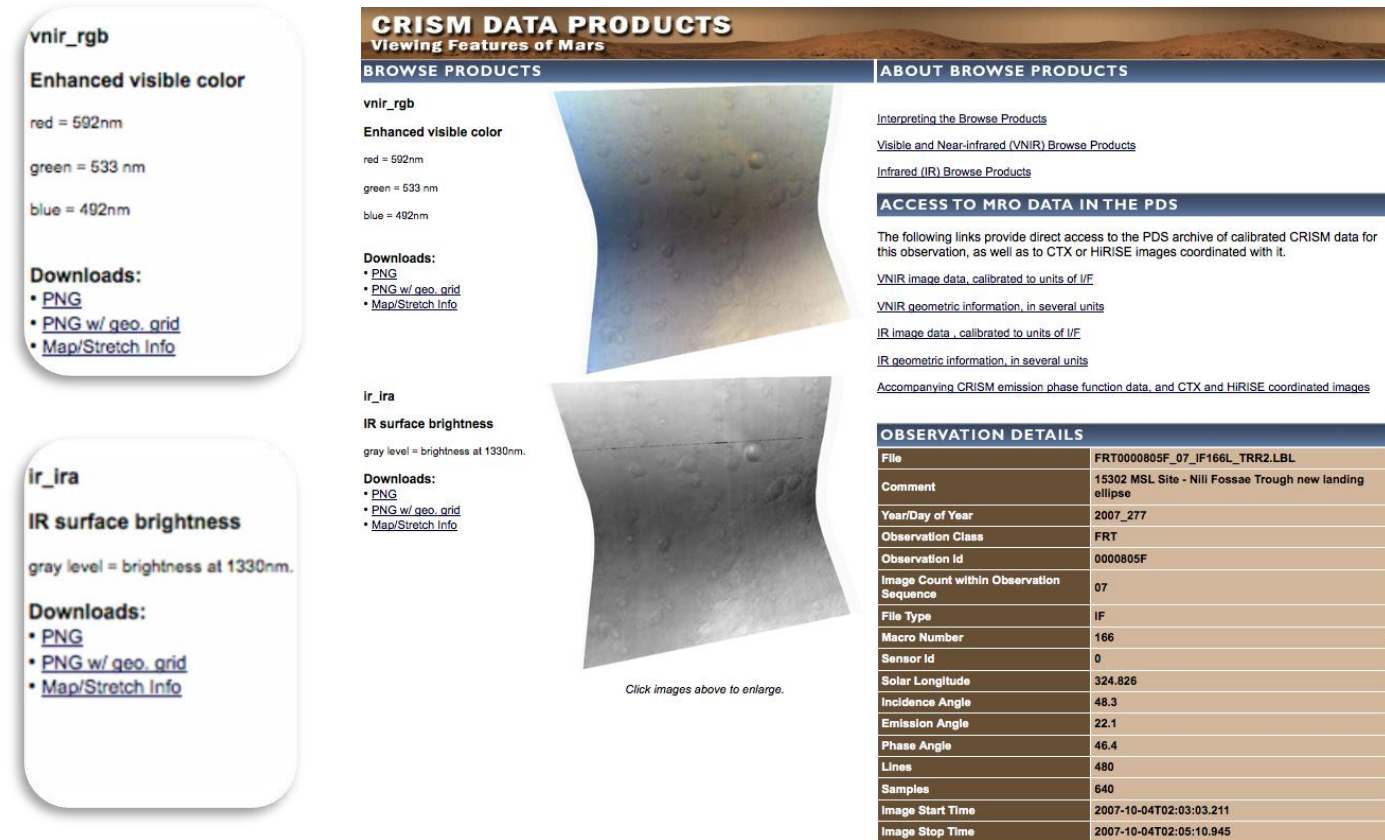
CRISM Consist of Three Boxes

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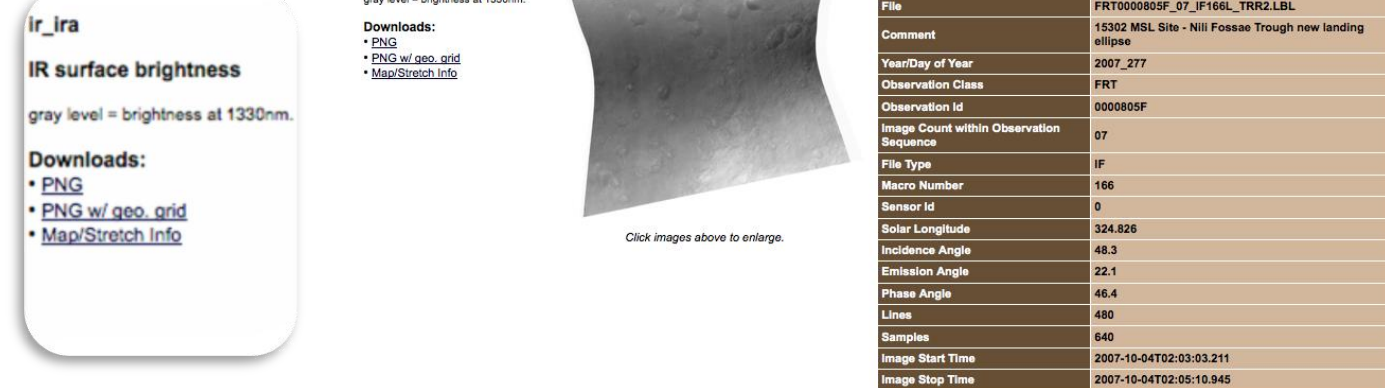 o Accepts and processes data from the OSU and Communicates it to the spacecraft

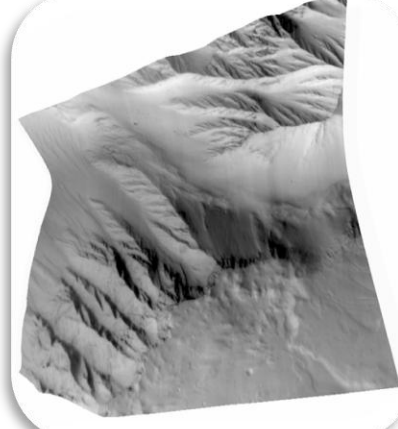## Database

Top Image:

Bottom Image:

Classification

Excellent
Fair
Poor
Absent

Excellent
Fair
Poor
Absent

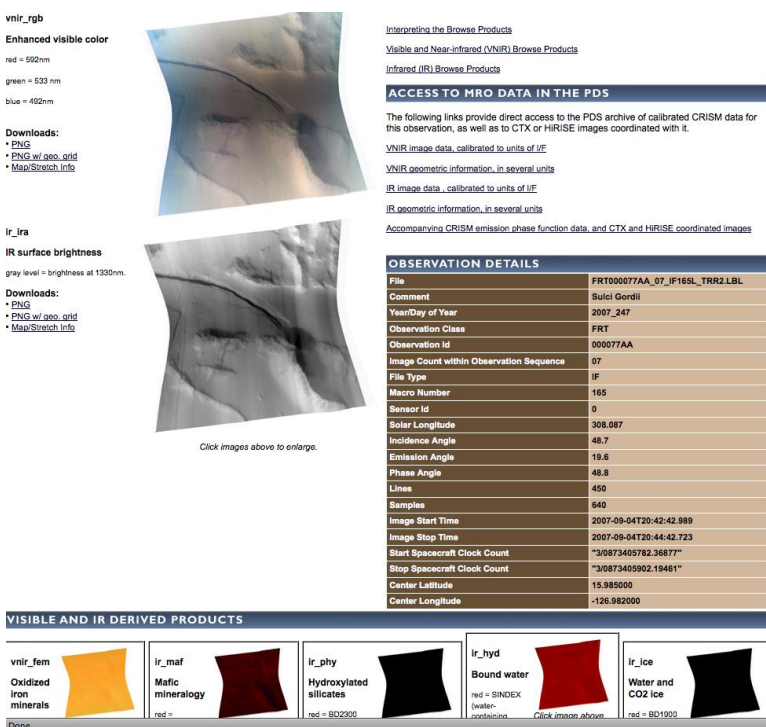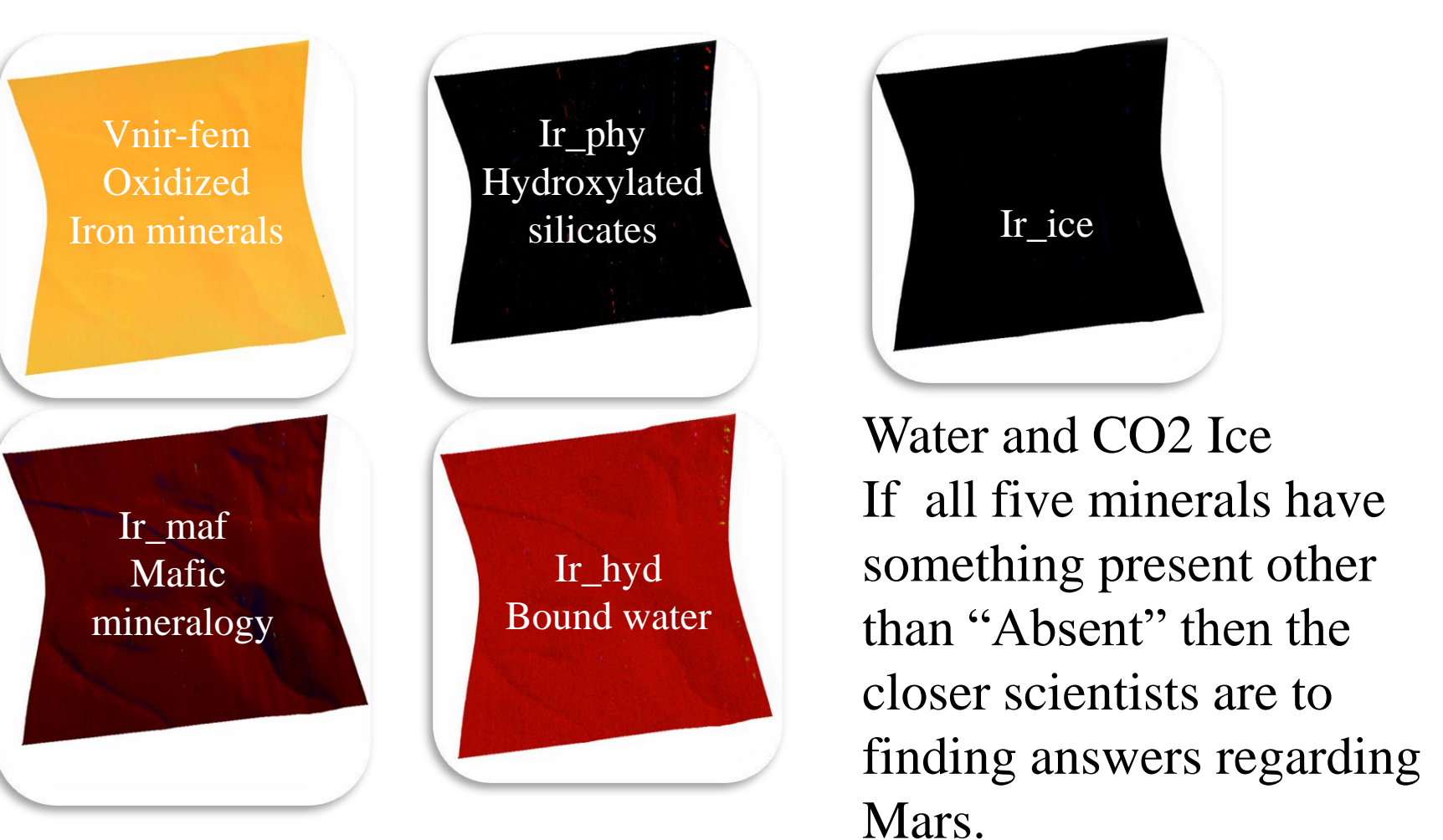Excellent
Fair
Poor
Absent

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
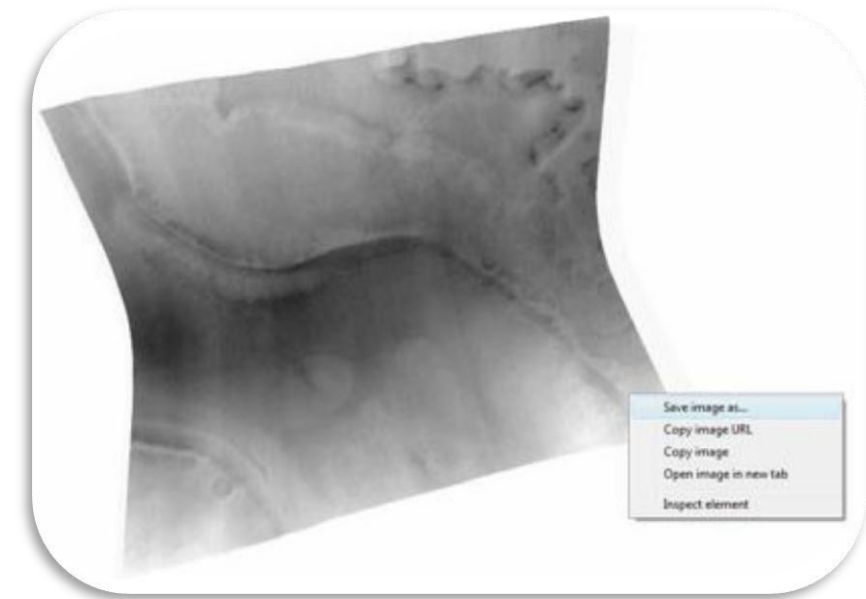• Ir_ice
  Water and CO2 Ice

Classification

Vnir-fem Oxidized Iron minerals

Ir_phy Hydroxylated silicates

Ir_ice

Ir_maf Mafic mineralogy

Ir_hyd Bound water

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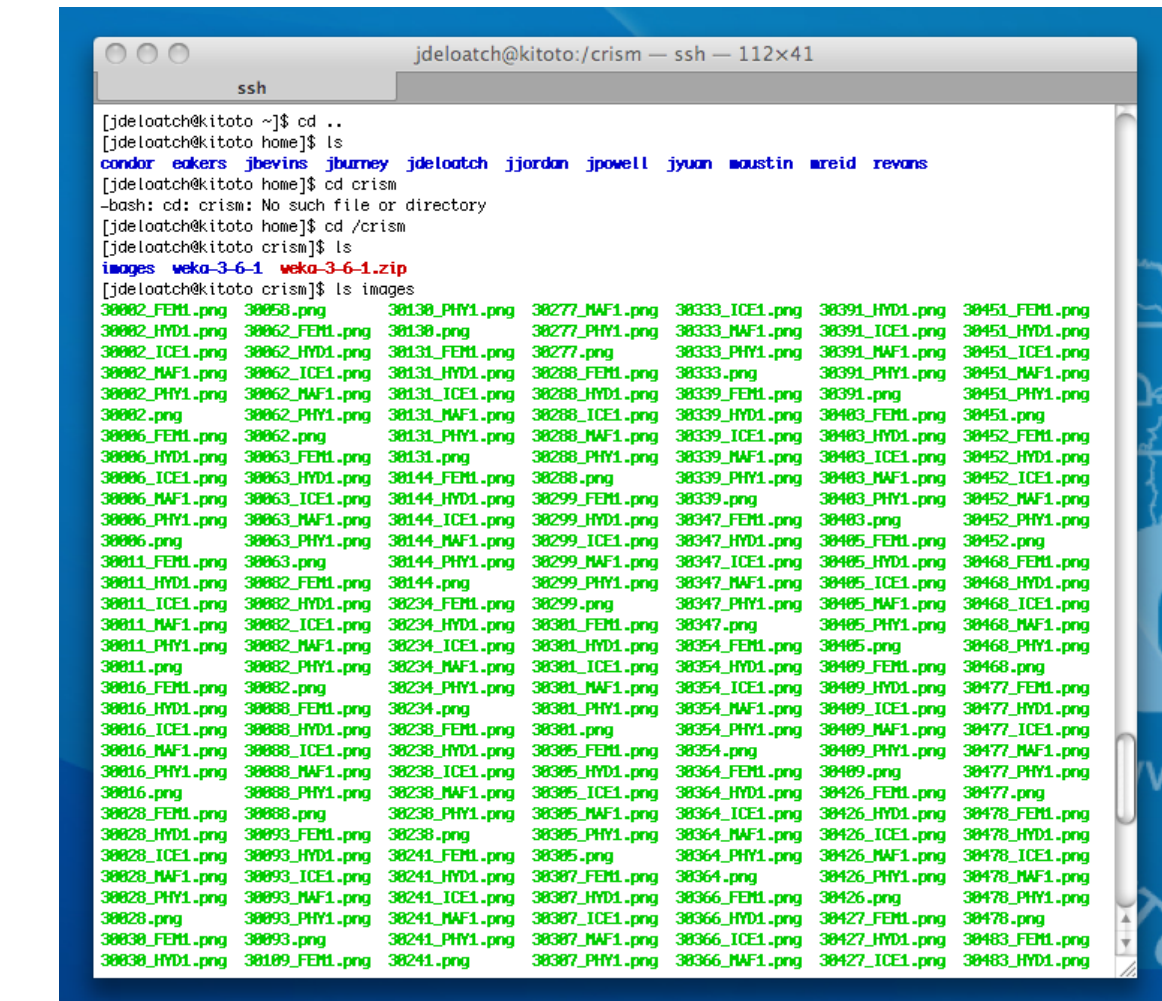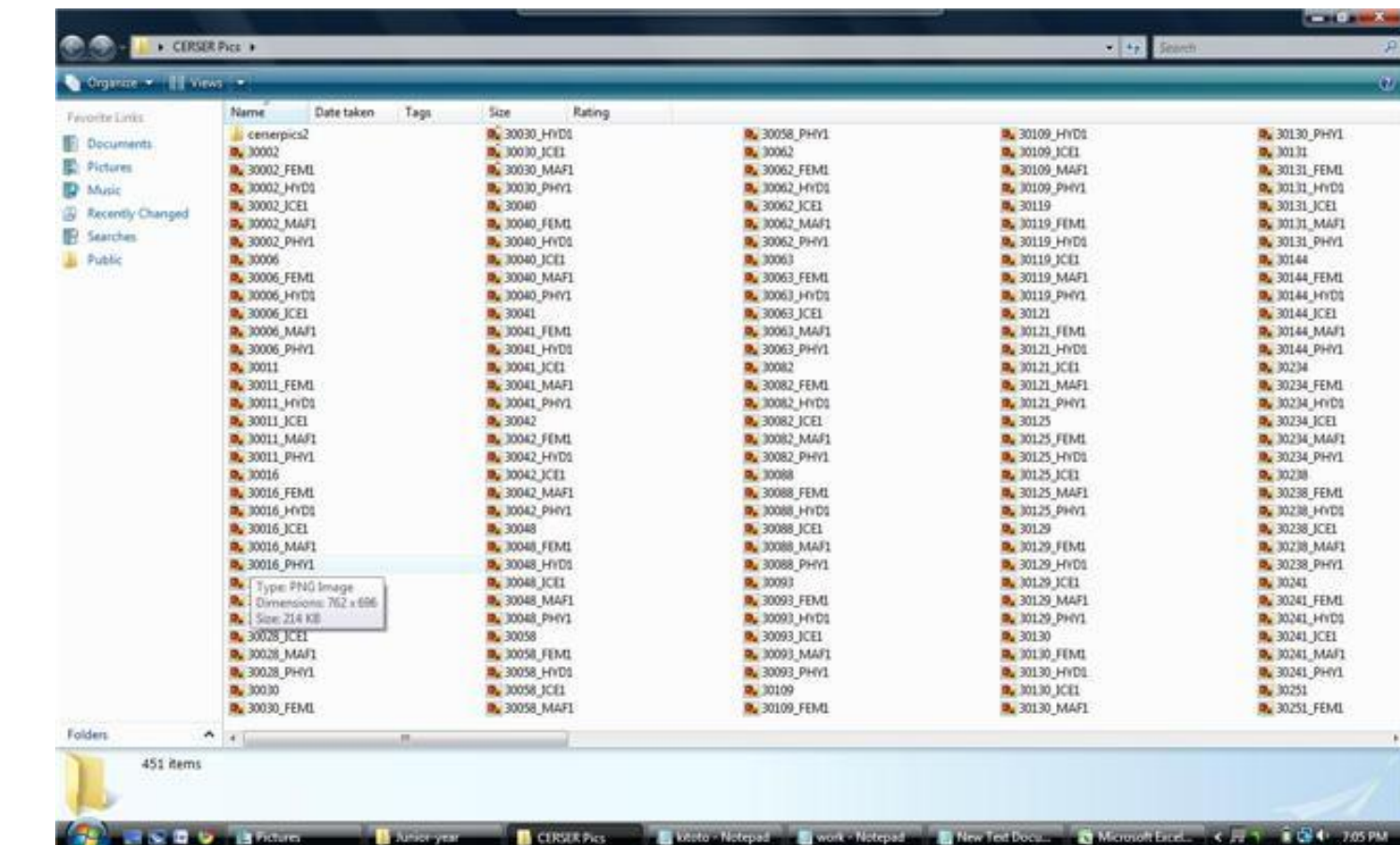
Downloading Images

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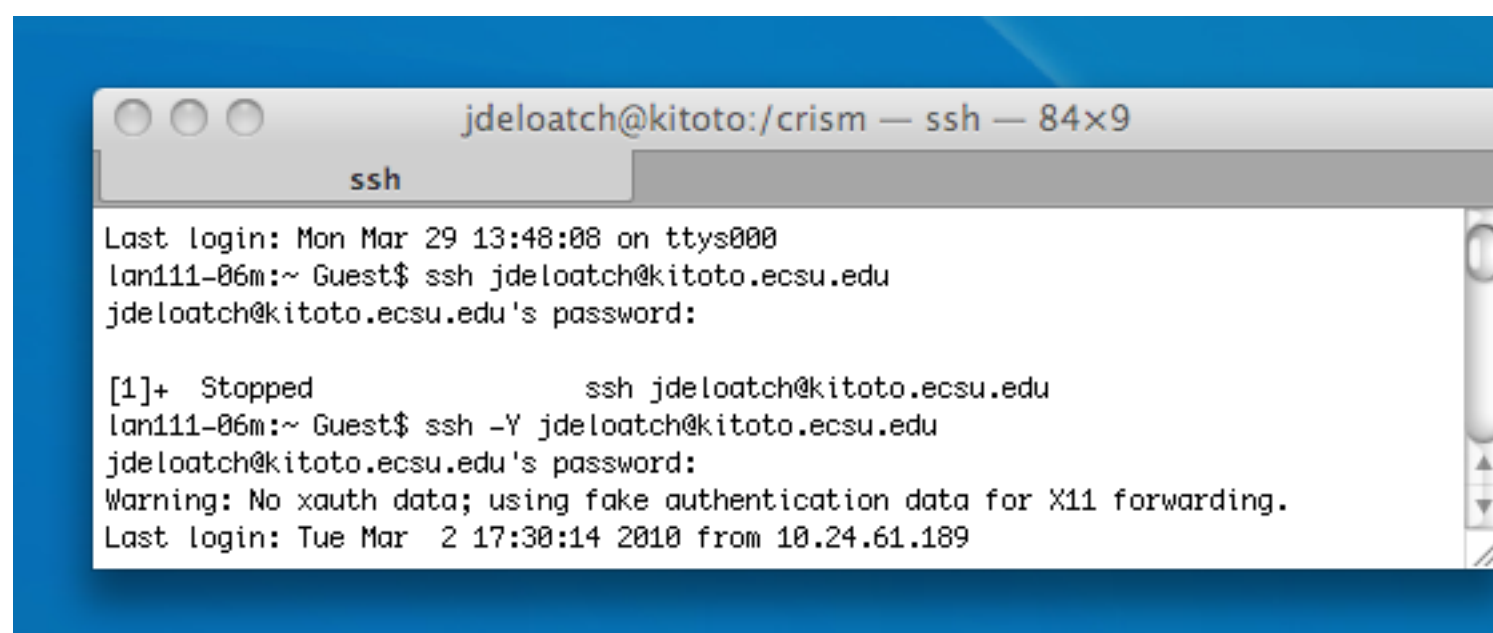• Enlarge the picture
• Save it to a destination
• Repeat steps

Moving Images Into Kitoto

Directory of saved pictures

Logging into Kitoto

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

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.

References

[1] JHU.APL Webmaster. CRISM Compact Reconnaissance Imaging Spectrometer for Mars. March 15 2010 from http://crism.jhuapl.edu/

[2] Jim Wilson. NASA http://www.nasa.gov