



Efficacy of Machine Learning in Analyzing Amino Acids & Minerals Using Fourier Transform Infrared Spectroscopy

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Abstract:

Infrared spectroscopy provides chemical information pertinent to several Mars biological questions. Life as we know it is composed of carbon-containing building blocks, organic molecules. This study was conducted to classify and predict varying concentrations of amino acids and rock using machine learning techniques. The selection of instruments for landing on Mars poses particular challenges. Instruments must withstand launch, vacuum space conditions and landing in the extreme environment. Fourier-transform infrared spectroscopy (FTIR), an analytical technique, meets the challenges and is broadly used to identify organic materials. In this study, several concentrations of L-stereoisomer serine and rock were pulverized and measured using

FTIR to obtain a spectrum of absorption. Each sample was measured in 5 sets then averaged to exclude errors. Using the R software environment, we performed Principal Component Analysis (PCA), a machine learning method for dimensionality reduction, to better visualize the story or data told. Preliminary results of our investigation indicate a separation of amino acid/rock mixture and pure rock at our sample concentrations 0.001g and 0.0001g. Further study includes measuring the separation of amino acid/rock mixture and pure rock at the parts per million level, improving on our analysis techniques and developing a method to detect signatures of life in Martian rocks.

Biography:

Christina Walker is a second-year Master of Science student at Delaware State University in Dover, Delaware. She holds a Bachelor of Arts in Physics with a minor in



Mathematics from Notre Dame of Maryland University in Baltimore, Maryland. Currently, she serves as the president of the Society of Photo-Optical Instrumentation Engineers (SPIE) Student Chapter at Delaware State University. Her hobbies include tennis, photography and spoiling her 3 cats. Following her master's degree, Christina will continue and pursue her Ph.D. in Optics at Delaware State University, Fall 2020.

Publication of speakers:

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3. Hansen, C.J., et. al. (2007). SPADE: A rock-crushing and sample-handling system developed for Mars missions. Journal of Geophysical Research, 112(E06008). doi: 10.1029/2005je002413

Webinar on Cyber Security 2020 | October 18, 2020 | London, UK

Citation: Christina J. Walker,,Efficacy of Machine Learning in Analyzing Amino Acids & Minerals Using Fourier Transform Infrared Spectroscopy; Cyber Security 2020; October 18th, 2020; London, UK.