With what follows, I am sure you can google to find papers to support the approach to build up references.

1. We are using CRISM MTRDR data:

Why - because this data is targeted to specific locations on Mars, it is high quality data and has already been scientifically pre-processed so we are working with good data and not having to do complicated and extensive pre-processing ourselves.  
  
<https://ode.rsl.wustl.edu/mars/pagehelp/Content/Missions_Instruments/Mars%20Reconnaissance%20Orbiter/CRISM/CRISM%20Product%20Primer/CRISM%20MTRDR.htm>  
  
Ask ChatGPT “Why use CRISM MTRDR data over other CRISM data sets, provide references please” and you’ll get a heap of reasons and references.

1. We are using an unsupervised Machine Learning approach because we have no validation data, the best we can do is group data together and classify.
2. To classify those groupings, we are going to derive the same 60 indicators/products as is contained in the CRISM MTRDR data from the raw spectral data of minerals in a lab. The spectral data for raw lab minerals is contained here, I believe/hope:

<https://crismtypespectra.rsl.wustl.edu/>

The output of that is going to be something like this:

* The lab data is what some of (not all) the 60 indicators from CRISM MTRDR data looks like:
* The Mars data is what the same indicators look like for the same minerals on Mars.  
    
  A black and white image of a number of letters

  AI-generated content may be incorrect.

If we identify the same signature in CRISM MTRDR data, we can classify that group is been a particular mineral or mineral group thanks to the lab data.  
  
The graph above and more information on this comes from:

Viviano-Beck, C. E., et al. (2014), Revised CRISM spectral parameters and summary products based on the currently detected mineral diversity on Mars, J. Geophys. Res. Planets, 119, 1403–1431, doi:10.1002/2014JE004627.

**Resources for you:**

* In terms of what these 60 indicators are in the CRISM MTRDR data, I have already generated some basic text for you on GitHub:

[**mars-minerals**](https://github.com/sydney-machine-learning/mars-minerals/tree/main)/[CRISM\_Info](https://github.com/sydney-machine-learning/mars-minerals/tree/main/CRISM_Info)/[Band\_Info](https://github.com/sydney-machine-learning/mars-minerals/tree/main/CRISM_Info/Band_Info)/Findings.docx

* Please note that is just one type of indicator, to provide some flavour as to how raw spectral data in CRISM has ended up in these 60 indicators or so that we see in the CRISM MTRDR data and the same calculations we will be doing on the raw lab data to be able to do our classification.