Machine Learning approaches for detection and classification of astrochemical spectra (P2.2)

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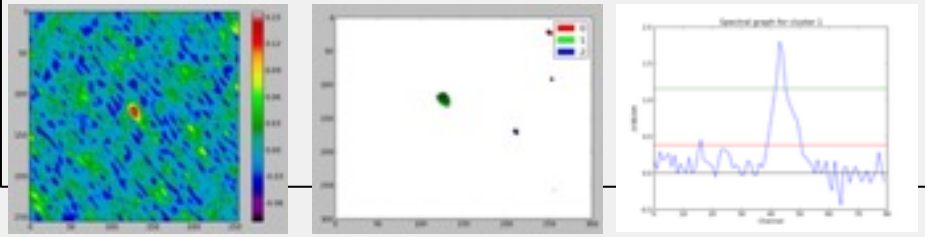
INTRODUCTION

- A couple of interesting problems:
  - Detection of regions of interesting emission in Astronomical Data Cubes.
  - Manual classification of astrochemical spectra can be a complicated task, several factors affect the characteristics of a spectral line on their way towards us.

DETECTION OF REGIONS OF INTEREST (ROI)

DBSCAN: Unsupervised clustering algorithm, ideal for irregular shapes, has some pros and cons. Executed over Moment-0 of a data cube. Works for high emission cubes.

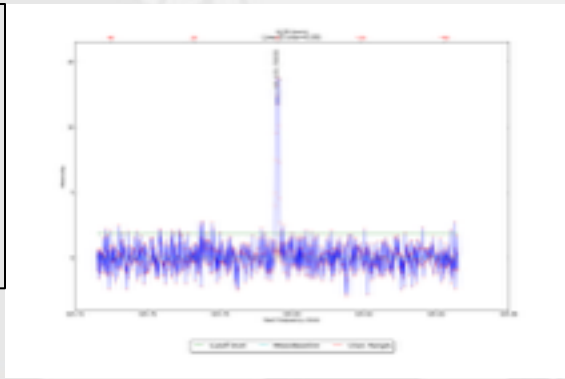


MACHINE LEARNING APPROACHES

Artificial Neural Networks and Support Vector Machines, both are very popular supervised classification methods, they have several properties that allow good generalization

TRAINING DATA

Modified ADMIT code to generate synthetic training examples
Initial physical parameters: Frequency and Intensity, more to come



Training Species

Species	Chemical Name	Ordered Freq (GHz) (rest frame)	Resolved QNs
COv=0	Carbon Monoxide	115.2712	1-0
COv=0	Carbon Monoxide	230.538	2-1
COv=0	Carbon Monoxide	345.796	3-2
COv=0	Carbon Monoxide	461.0408	4-3
COv=0	Carbon Monoxide	576.2679	5-4
COv=0	Carbon Monoxide	691.4731	6-5
HCO+v=0	Formylium	356.7342	4-3
cis-CH2OHCHO v=0	Glycolaldehyde	220.2041	11(4,7)- 10(3,8)
cis-CH2OHCHO v=0	Glycolaldehyde	220.1967	7(6,2)- 6(5,1)
cis-CH2OHCHO v=0	Glycolaldehyde	220.1969	7(6,1)- 6(5,2)
SO2v2=1	Sulfur dioxide	345.80717	80(7,73)-81(6,76)
CH3C4H	Methyl diacetylene	345.78207	85(5)-84(5)
SO2v=0	Sulfur dioxide	356.75518	10(4,6)-10(3,7)
CH3OCHOv=1	Methyl Formate	345.79385	29(13,16)-29(12,17)A
CH3OCHOv=1	Methyl Formate	345.79392	29(13,17)-29(12,18)A
c-H13CCCH	Cyclopropenylidene	345.79652	8(2,6)-7(2,5)
CH3OCHOv=0	Methyl Formate	345.79665	50(12,38)-49(13,37)A