Celestial Object Classification

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Outline

Section 1

Astronomical Challenge

Astronomical Challenge

Classifying celestial objects into stars, galaxies or quasars using their spectral characteristics.

Section 2

Data & Preprocessing

Image of the celestial objects

Figure 1: Galaxy

Figure 2: Star

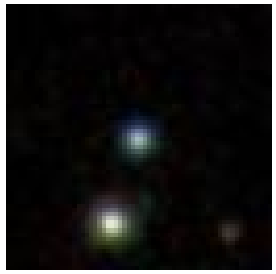


Figure 3: Qusar

Image of the spectra

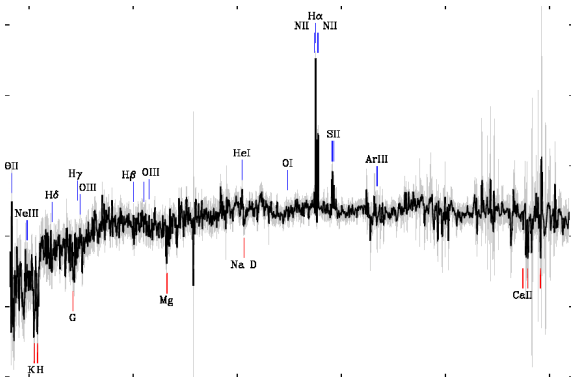


Figure 4: Galaxy Spec

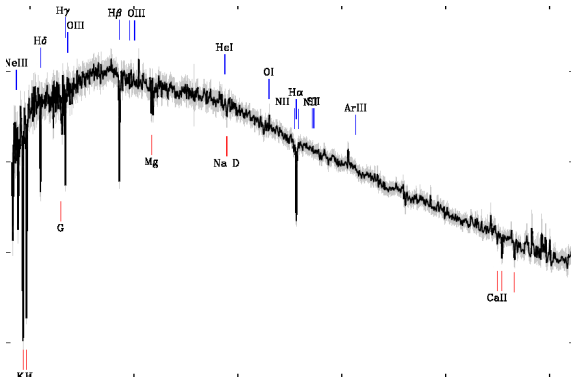


Figure 5: Star Spec

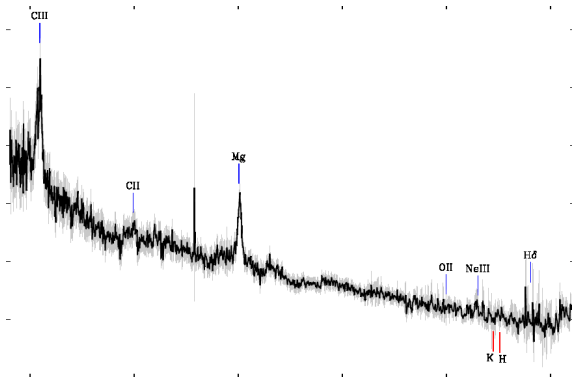


Figure 6: Qusar Spec

Metadata

Table 1: Metadata of the celestial objects

vars	explanations
ra	Right Ascension angle (at J2000 epoch)
dec	Declination angle (at J2000 epoch)
u	Ultraviolet filter
g	Green filter
r	Red filter
i	Near Infrared filter
z	Infrared filter
run	Run Number
rerun	Rerun Number
camcol	Camera column
field	Field number
specobjid	Unique ID used for optical spectroscopic objects
class	Object class
redshift	Redshift value based on the increase in wavelength
plate	Plate
mjd	Modified Julian Date

EDA

- Missing Values: 3
- Samples for each catagory: 33333

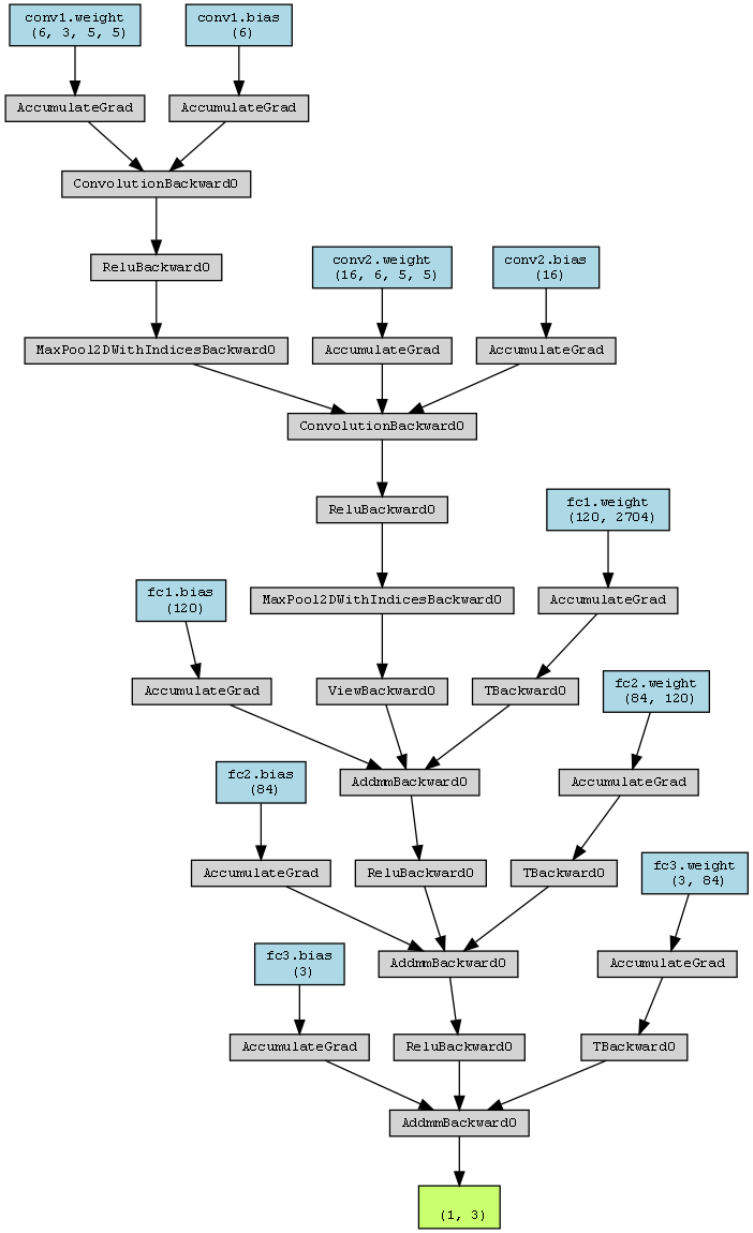
Section 3

Methodology

Meta Data

- Explanatory Variables: u, g, r, i, z, redshift
- Response Variable: class
  - STAR: 0
  - GALAXY: 1
  - QSO: 2
- kNN: k = 3
- Decision Tree
- Logistic Regression

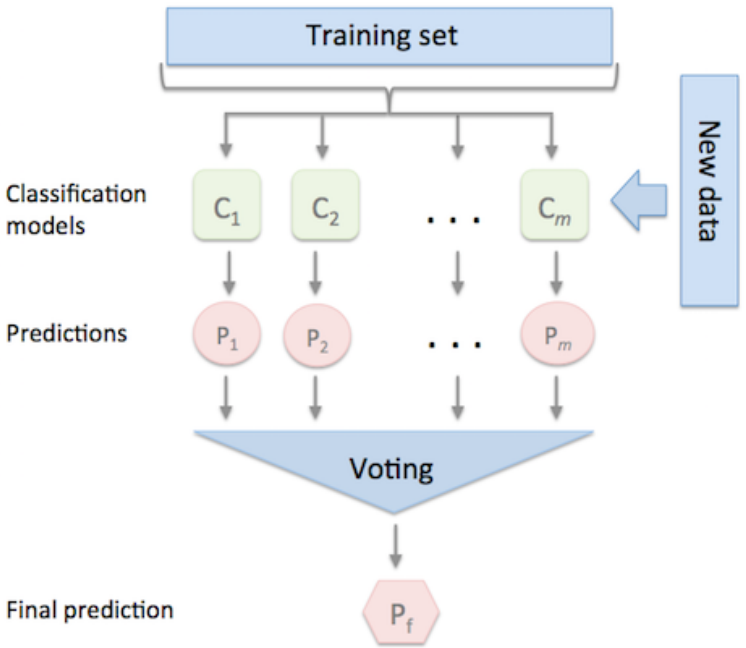
Images



- Concepts:
  - Origin: 0 interior edge
  - Edge
  - Orthant ($n-2$ dimension)
- Construction:

  Taking one $n-2$ dimensional orthant for each of the $(2n-3)!!$ possible binary trees, and gluing them together along their common faces. Then we will get the BHV tree space $\mathcal{T}_n$.

Voting Classifier



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Section 4

Results

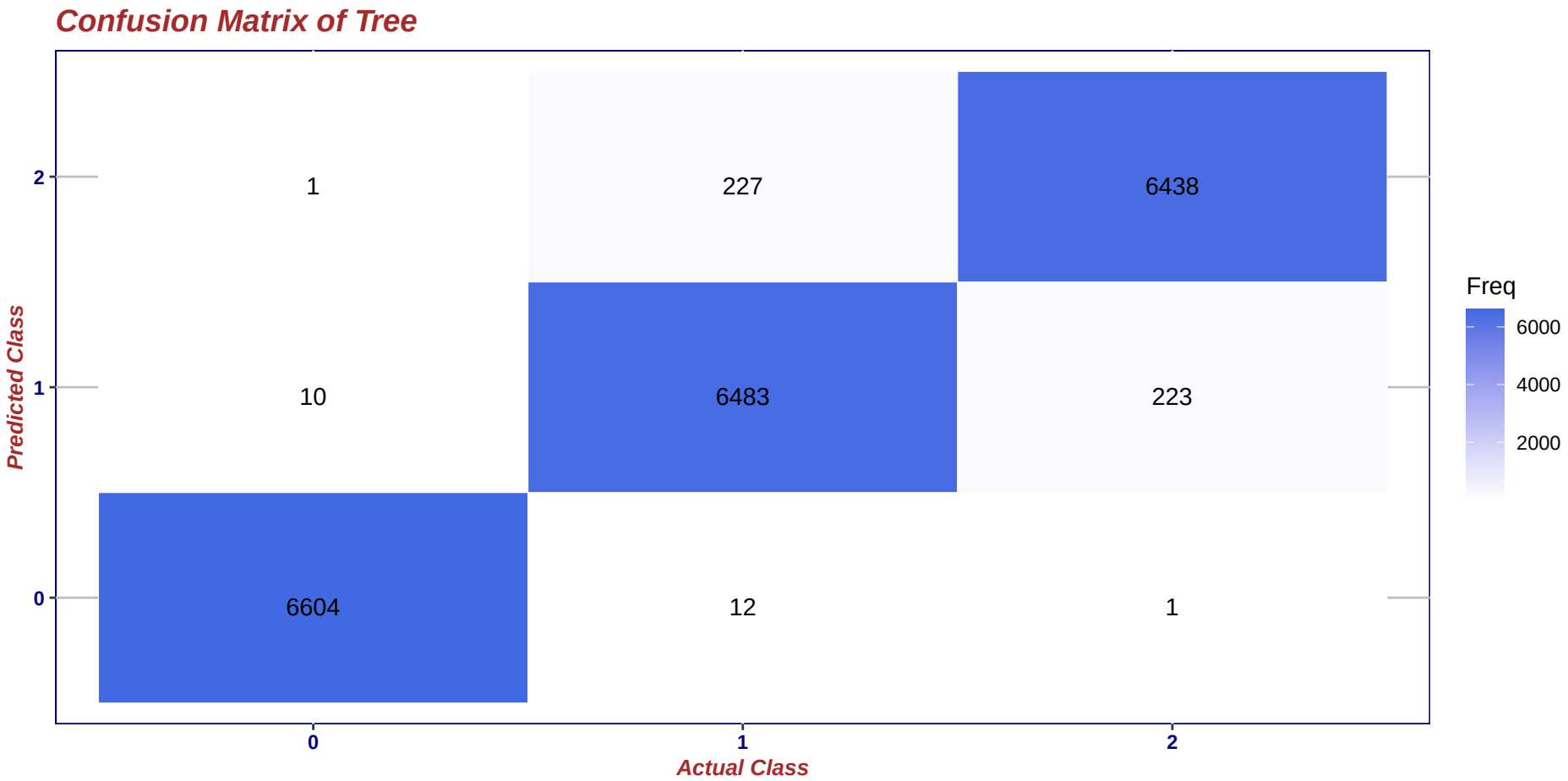

Figure 7: Confusion Matrix of Decision Tree

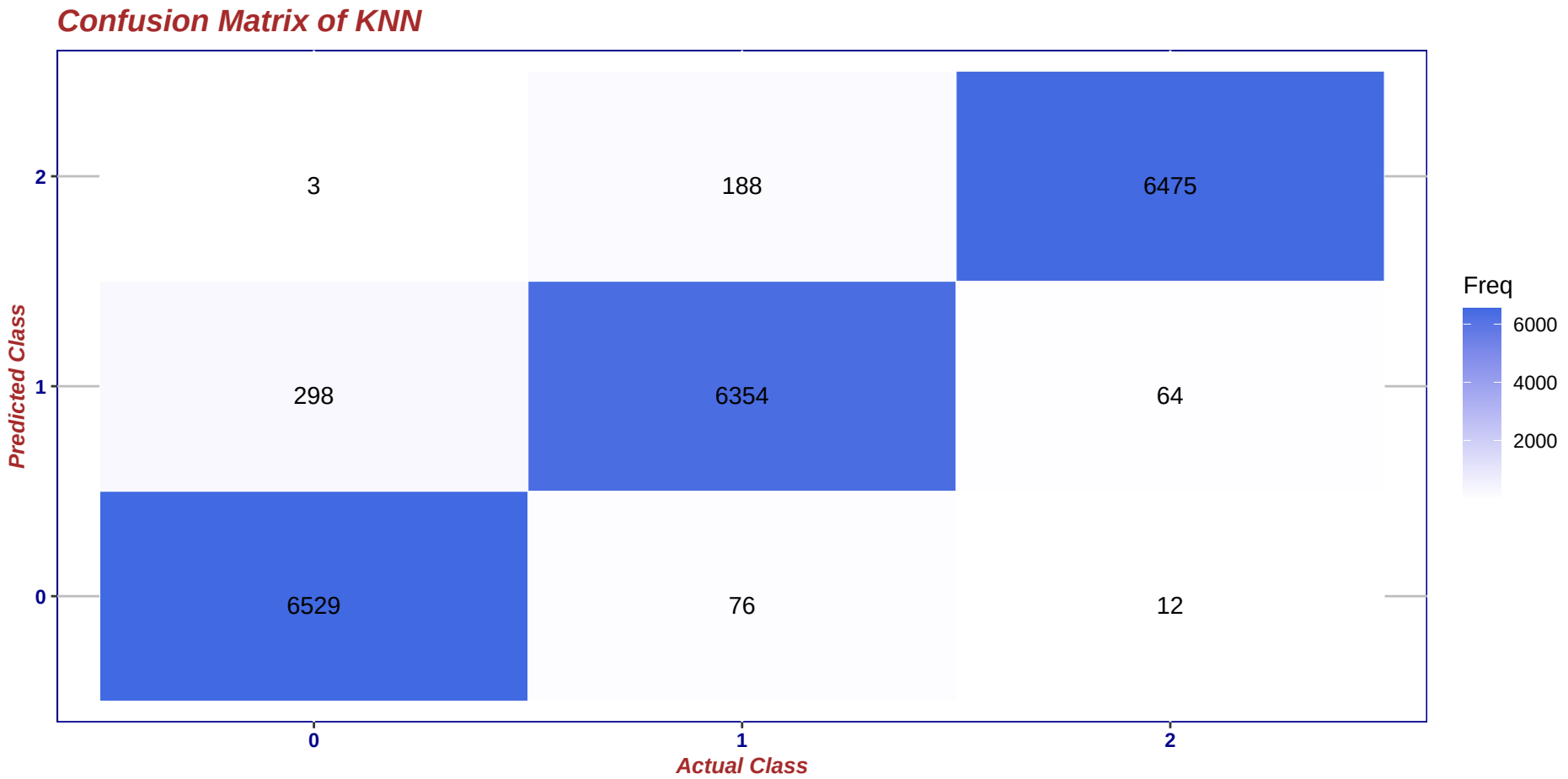

Figure 8: Confusion Matrix of kNN

Metadata

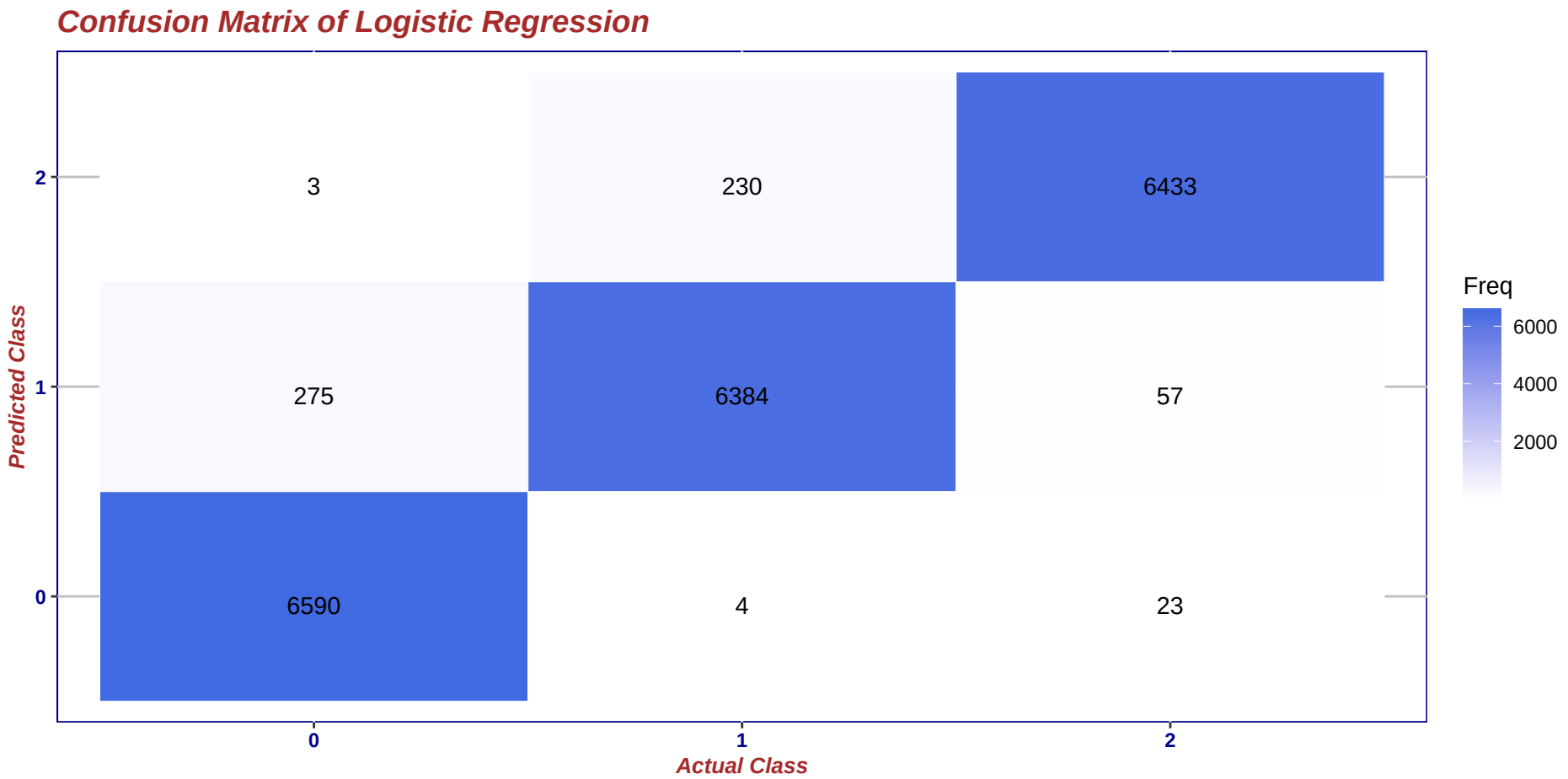

Figure 9: Confusion Matrix of Logistic Regression

Image of the celestial objects

Image of the spectra

References I