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Disclaimer: I am not an astronomy expert. This work is a personal exploration based on estimates and analyses of the available data, aiming only at practical learning of the Tableau tool and preliminary interpretation of the data.

Galactic Harmony: A Journey in Tableau Through Mass, Light, and Time

Objective

This document aims to guide the exploration of the universe through the analysis of an astronomical database using Tableau. We seek to uncover patterns and correlations among the properties of galaxies, such as mass, brightness, and their location in cosmic time (redshift), with the goal of better understanding the "galactic harmony" and the evolution of these majestic structures.

Dataset Used

The dataset "Galaxy Morphology Classification 1.0" from Kaggle, available in CSV format (corresponds to the file Buzzard_DC1.xlsx - Buzzard_DC1.csv).
Link: https://www.kaggle.com/code/tatvajoshi123/galaxy-morphology-classification-1-0

This dataset contains brightness data in different light bands (u, g, r, i, z, y), their errors (u.err, g.err, etc.), the logarithmic mass (log.mass), and the redshift of the galaxies.

Initial Questions

1. What is the distribution of galaxy masses across different redshifts?
Understanding: We want to see where galaxies cluster in the mass-redshift space.
Graph Setup (Desired Final State): Scatter plot with redshift on the X-axis (continuous measure) and log.mass on the Y-axis (continuous measure, no aggregation), where each point represents an individual galaxy.
Conclusion: Observing the scatter plot, galaxies of various masses are present across nearly all observed redshifts. However, there is a common concentration of more massive galaxies at lower redshifts (closer and more recent universe), while at higher redshifts (more distant and younger universe), the mass distribution may differ, potentially with fewer extremely massive galaxies or a more uniform distribution, indicating the evolution of galactic structures over cosmic time.

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2. Is there any correlation between the color (difference in brightness between filters) of galaxies and their mass?
Understanding: The "color" of a galaxy can indicate its stellar age or star formation rate (bluer galaxies generally form stars actively, while redder ones are older). We want to see if galaxies of different masses tend to have specific colors.
Tableau Setup: Scatter plot with color (g-r) (calculated field [g]-[r]) on the X-axis (continuous) and log.mass on the Y-axis (continuous, no aggregation). Points are colored by redshift.
Conclusion: Yes, the plot shows a strong positive correlation: more massive galaxies (higher log.mass) tend to be redder (higher color (g-r)), while less massive galaxies are bluer. This dichotomy reflects the "red sequence" (old, quiescent galaxies) and the "blue cloud" (young, star-forming galaxies). Coloring by redshift reveals that high redshift galaxies (younger universe) are predominantly less massive and blue, indicating a phase of intense star formation. The accumulation of massive red galaxies at lower redshifts (more recent universe) suggests that massive galaxies have "matured" and "quenched" over cosmic time.

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3. Which filter (light band) shows the greatest or least dispersion (variety) in the brightness of the observed galaxies?
Understanding: We want to see in which part of the light spectrum (u, g, r, i, z, y) the brightness of galaxies varies the most. This can indicate which physical processes (star formation, dust, older galaxies) are more diverse or have a greater impact on brightness in certain "colors."
Tableau Setup: Scatter plot with color (g-r) (calculated field [g]-[r]) on the X-axis (continuous) and log.mass on the Y-axis (continuous, no aggregation). Points are colored by redshift.
Conclusion: The graph shows the same strong positive correlation mentioned above between mass and color, reinforcing the "red sequence" and "blue cloud" patterns, and the relationship with redshift.

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4. What is the relationship between a galaxy's apparent magnitude (brightness) and the error of its measurement for a given filter (e.g., 'g' band)? Does this change with redshift?
Understanding: This question is crucial to understanding the quality of the data. Generally, fainter objects (larger magnitudes) or more distant objects (higher redshifts) are harder to measure and thus tend to have larger measurement errors. Identifying these patterns helps evaluate the reliability of conclusions.
Tableau Setup: Scatter plot with g (magnitude) on the X-axis (continuous, no aggregation) and g.err (error) on the Y-axis (continuous, no aggregation). Points are

colored by redshift.
Conclusion: The plot demonstrates a fundamental relation in observational astronomy: the fainter the galaxy (higher g magnitude), the larger the measurement error (g.err) tends to be. This trend forms a "trumpet" or "wing" shape in the graph. Coloring by redshift shows that galaxies with higher redshift (more distant and intrinsically fainter) cluster in the region of higher magnitude and larger errors. This conclusion highlights that measurement precision decreases for fainter and more distant objects, a crucial factor in interpreting astronomical data.