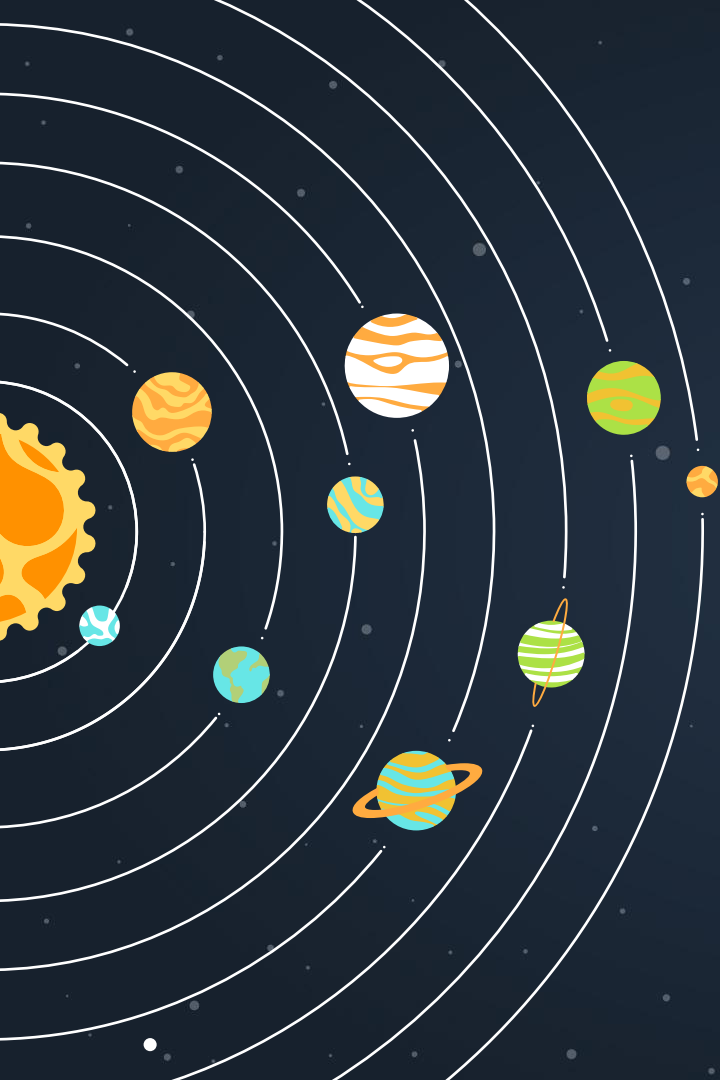
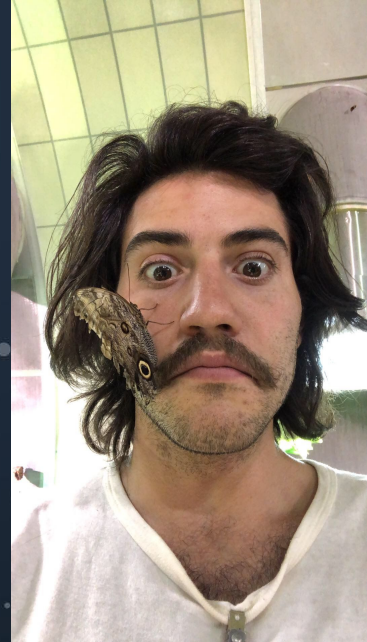


RAFAEL FERREIRA

Astrophysicist/Data Scientist





HABITABLE ZONE DETECTION

Determining if exoplanets live
within their habitable zone

TABLE OF CONTENTS

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INTRODUCTION

02

PREPROCESSING

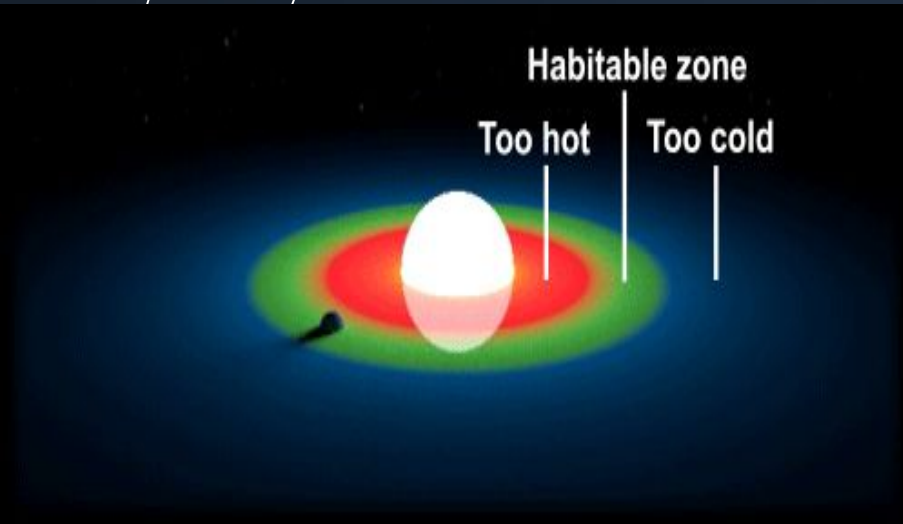
03

MODELING

04

FUTURE STEPS

INTRODUCTION



25 years of discovery

- 4,000 plus observations
- 20 plus features



Several different types of methods

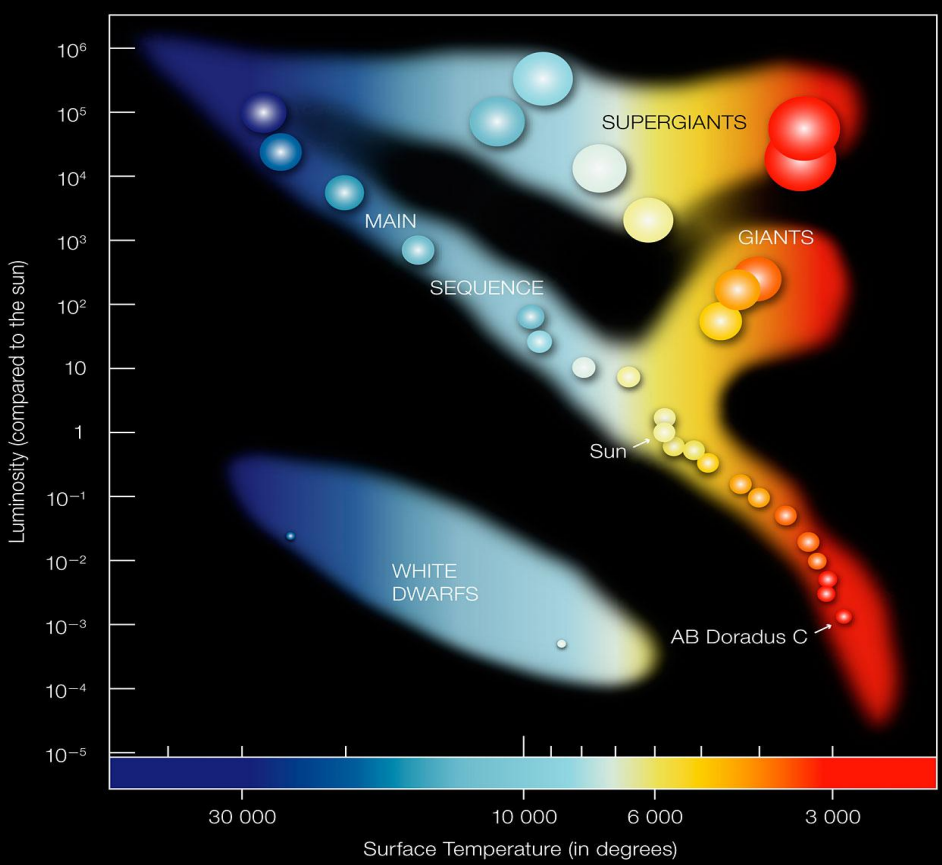
- Radial Velocity
- Direct Imaging
- Transit Method



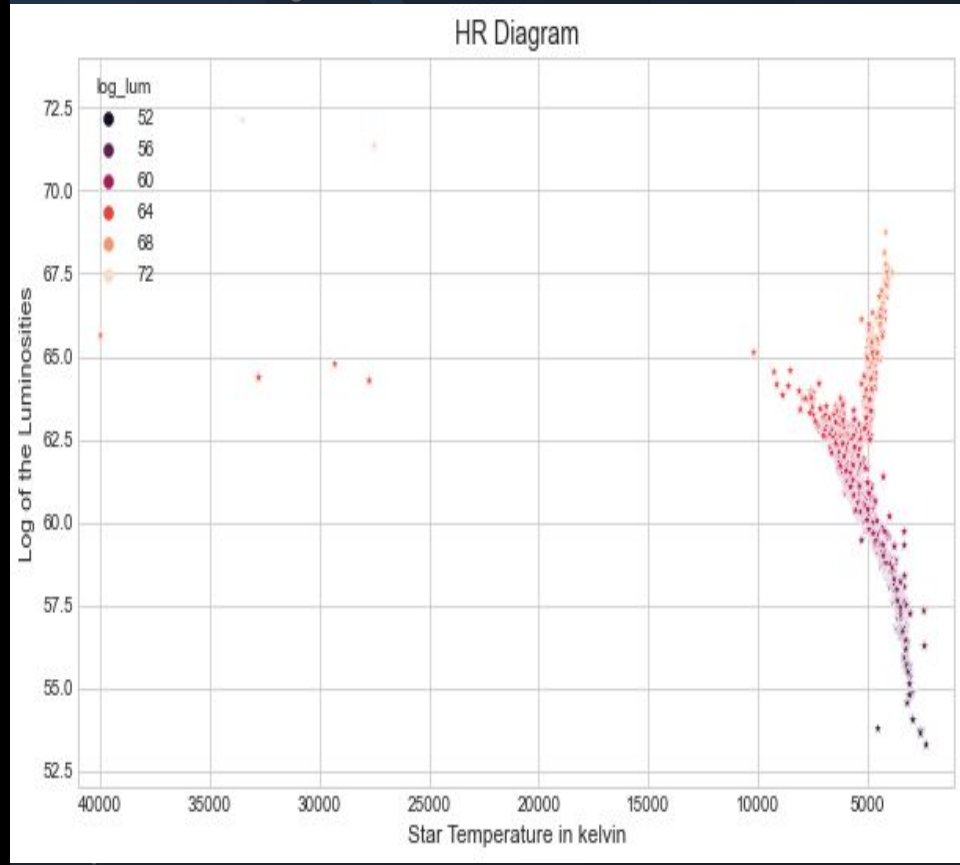
Sole focus: Habitable Zone

- Lies within the habitable zone or not

MODEL HR DIAGRAM



HR DIAGRAM OF EXOPLANET HOST STARS





ORBITS OF PLANETS

Kepler's Third Law:

$$a^3 = p^2$$

PREPROCESSING



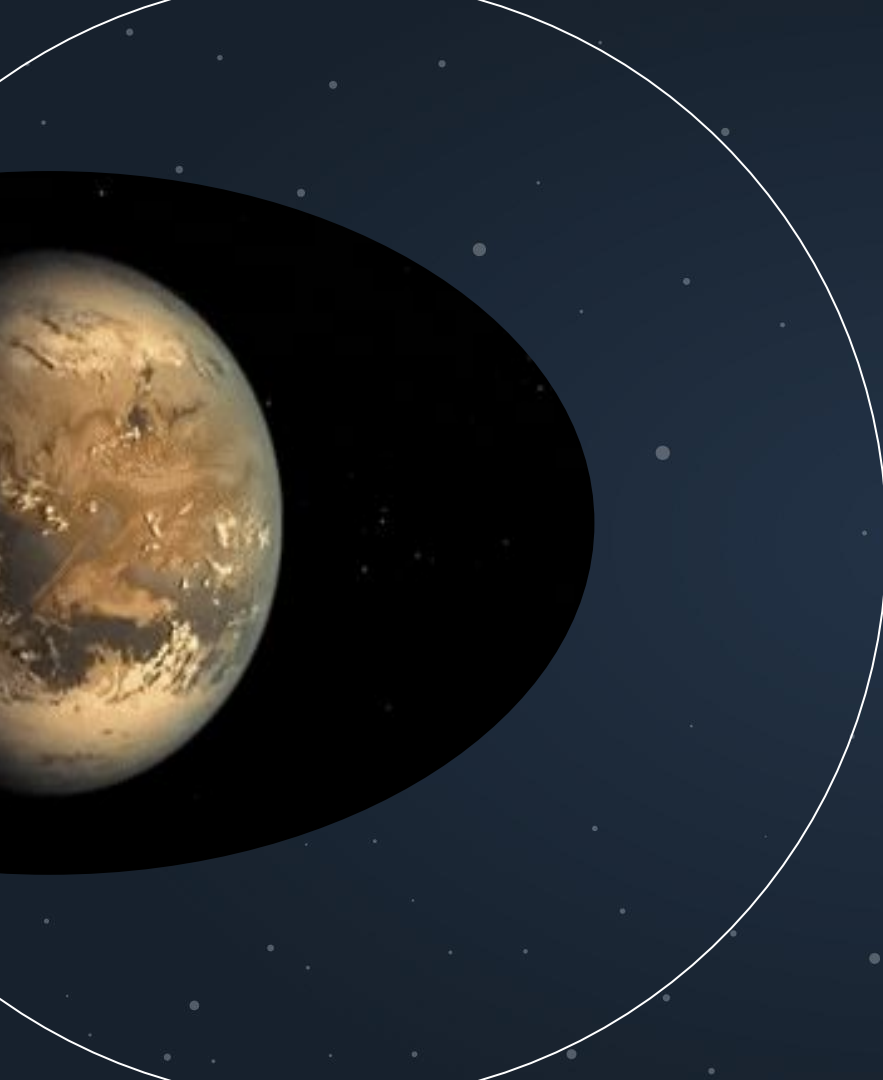
LUMINOSITY

$$L = \sigma 4\pi R^2 T^4$$



HB ZONE

- 273 K
- 373 K



MODELING



RandomForest

F1 score: 0.37



Xgboost

F1 score: 0.26



LightGBM

F1 score: 0.27

GRIDSEARCH

RANDOMFOREST

- Performed best as a base model

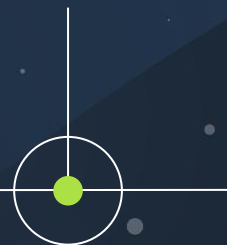
F1 = 0.26



LIGHTGBM

- Overall best performance in Recall

F1 = 0.415



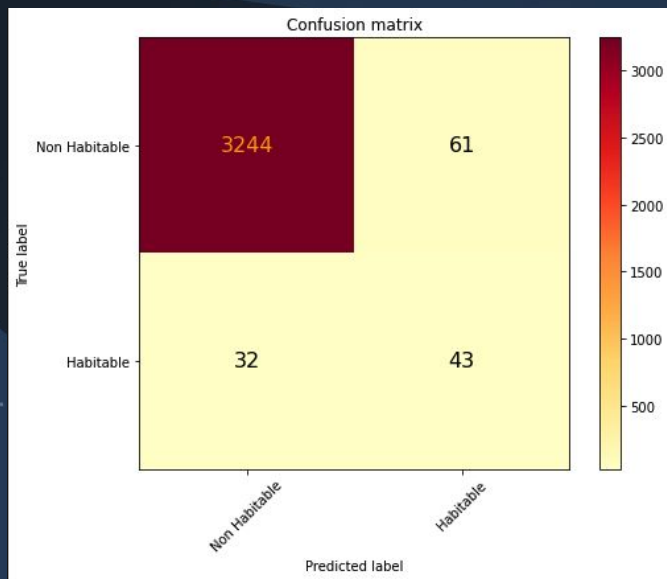
XGBOOST

- Overall best performance

F1 = 0.48



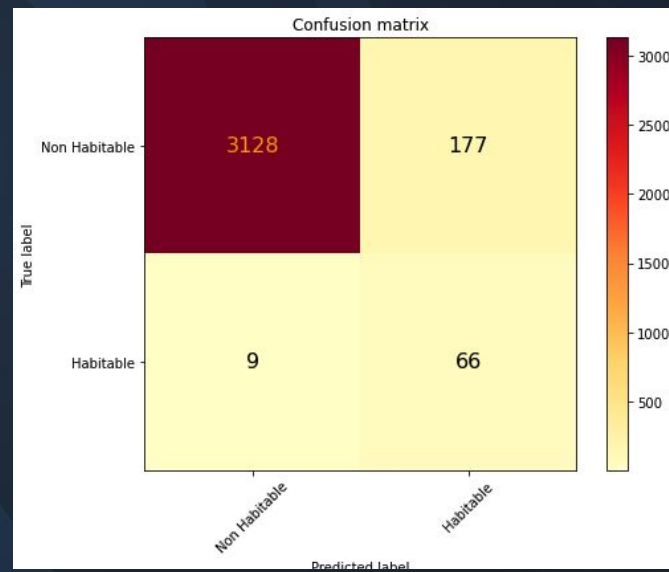
Best Model: F1 Score 0.48!



XGBOOST: Outperformed in detecting exoplanets within the habitable zone and outside it.



Best Model for Recall: 0.89!



LightGBM: Outperformed in the sensitivity of predicting exoplanets within their habitable zones.



CONCLUSION - FUTURE WORK



Imbalance classes

- Albedo effect taken into account
- Trying different balancing methods

More Data

- Future observations will add to data

Neural Networks

- Once more data is collected use Neural Networks to create predictions

THANKS!

Do you have any questions?



Email

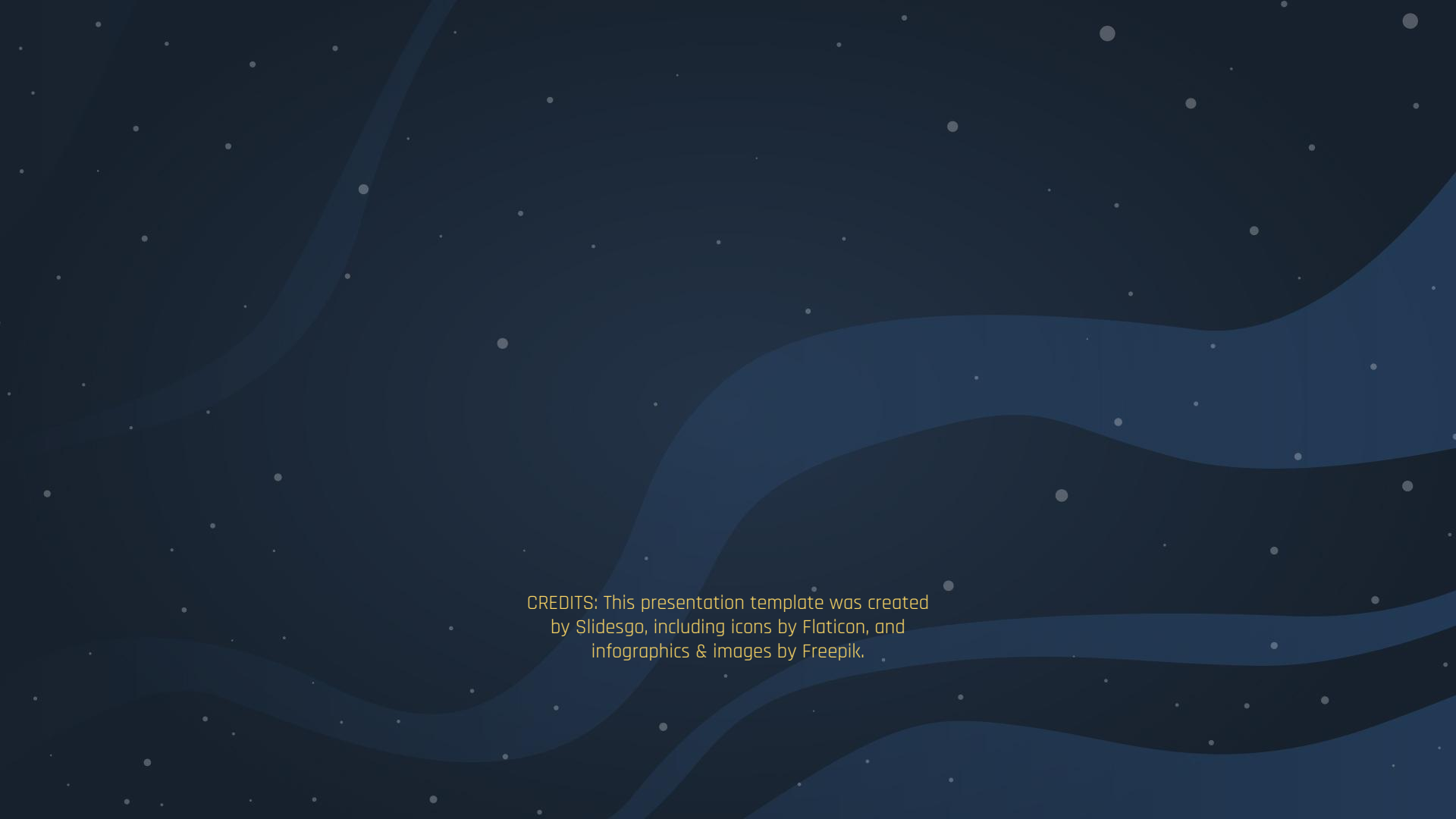


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ALTERNATIVE ICONS



ALTERNATIVE RESOURCES



RESOURCES

PHOTOS

- Blackboard-with-rocket-and-pens
- Abstract-background
- Outstanding-beauty-clarity
- Abstract-background-with-planets
- Abstract-background-Shooting-stars
- Plane-made-chalk
- Backpack-with-books-near-cup
- Girl-with-shuttle-toy-nature
- Abstract-arrangement
- Black-trees-autumn-starry-night
- Evergreen-trees-seen-night
- Abstract-background-with-blue-pink
- Ground-view-beautiful-trees-sky
- Abstract-background



RESOURCES

VECTORS

- Modern-astronaut-character-with-flat-design
- Solar-system-infographic
- Lovely-galaxy-background-with-flat-design
- Solar-system-infographic-pack
- Outer-space-concept-illustration
- Flat-design-universe-infographic-concept
- Solar-system-infographic-concept
- Space-Icon-Pack
- Universe-32
- Solar-system-template-infographic
- Universe-infographic-with-solar-system
- Space-infographic-elements
- Flat-design-universe-infographic
- Universe-infographic-flat-design
- Solar-system-infographic
- Flat-design-universe-infographic
- Flat-design-theme-universe-infographic
- Hand-drawn-timeline-infographic

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Cuate

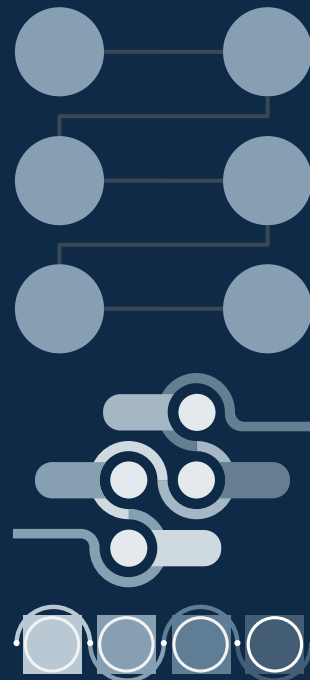
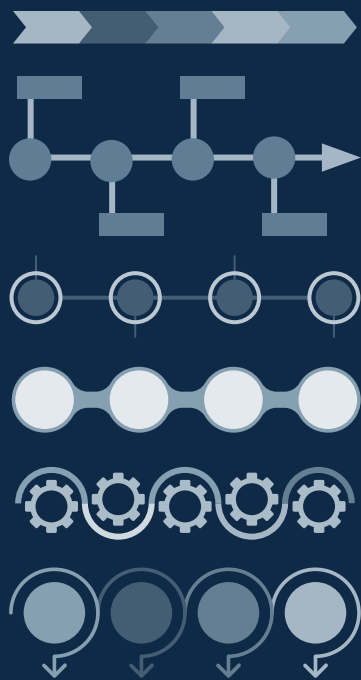
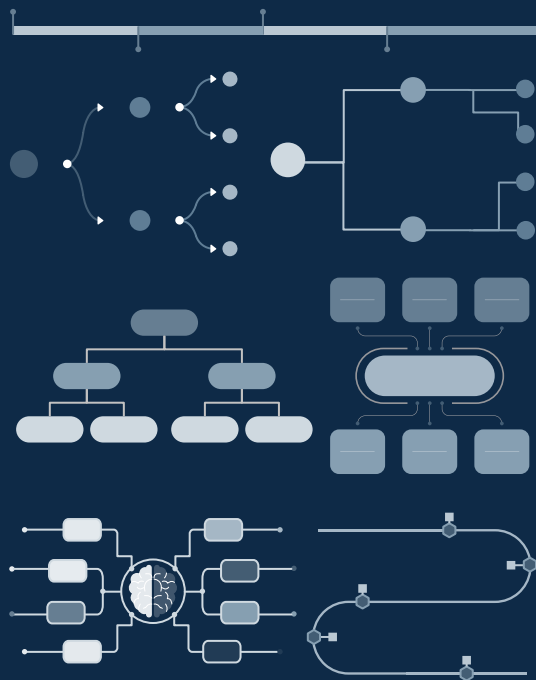
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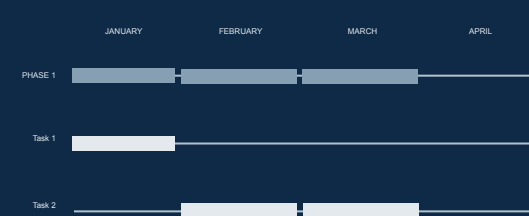
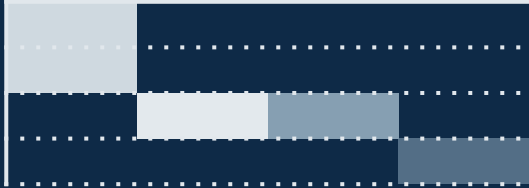
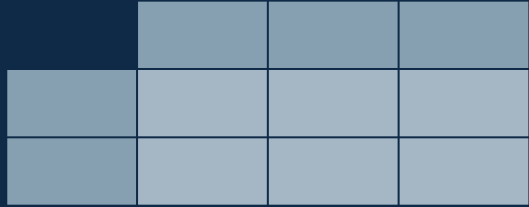
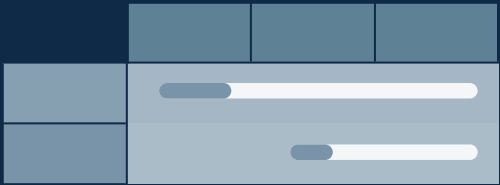
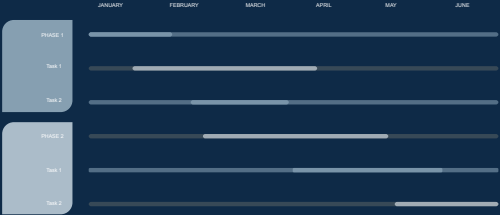
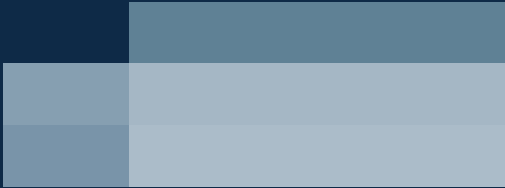
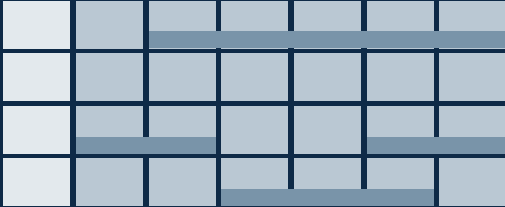
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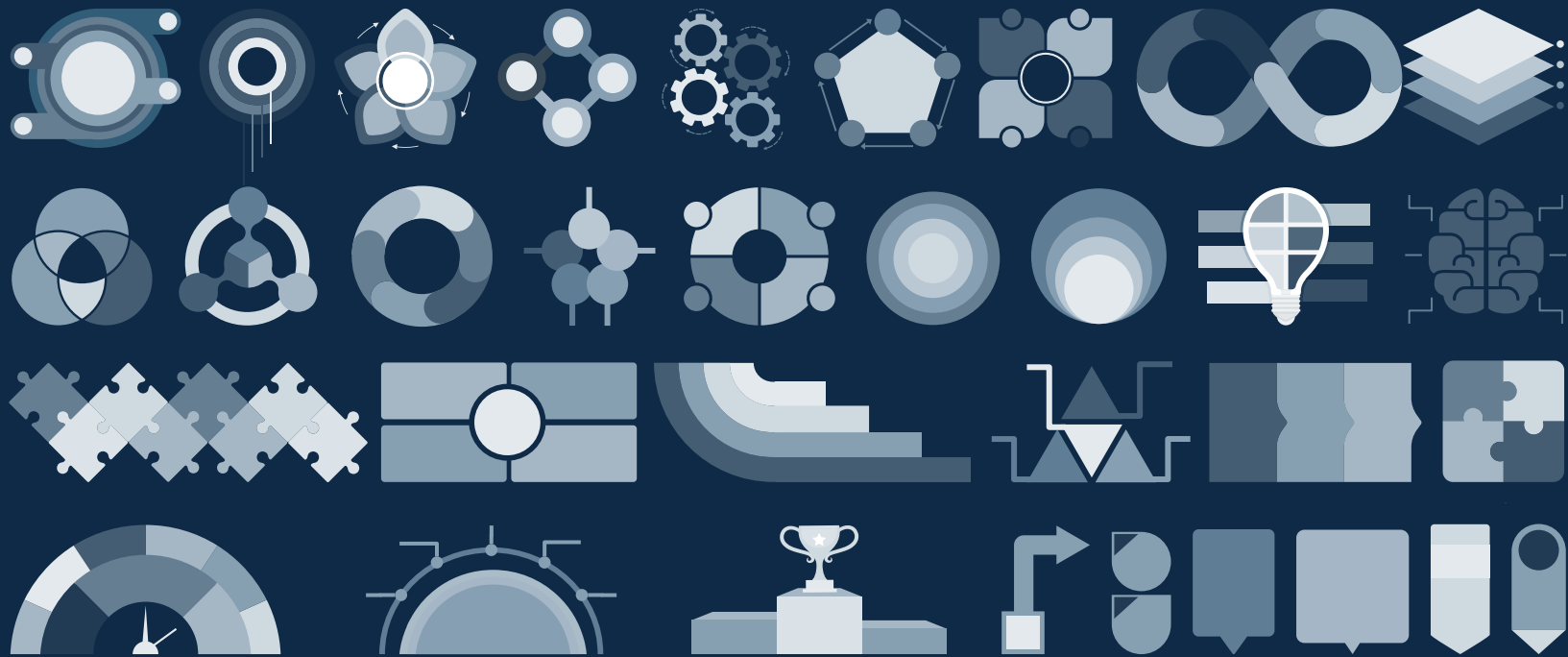
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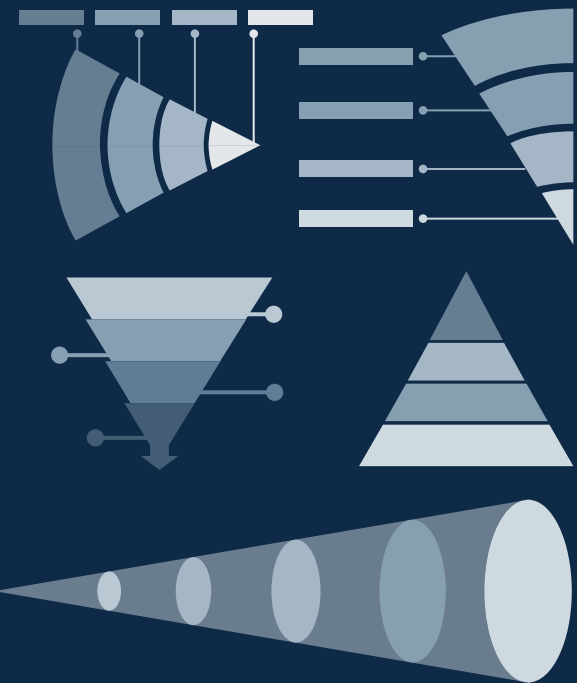
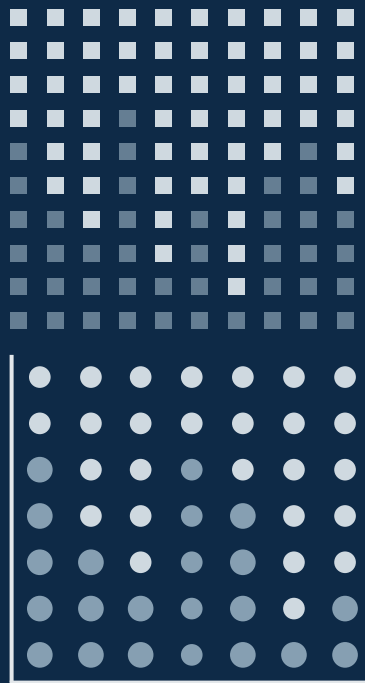












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Educational Icons



Medical Icons



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