Data-Science 3

What is our GOAL for this MODULE?

The goal of this module is to filter more exo-planets by applying statistics and machine learning.

What did we ACHIEVE in the class TODAY?

- We plotted different charts in this class
- We learned about the Goldilock zone of a planet
- We calculated the speed of all the planets

Which CONCEPTS/CODING BLOCKS did we cover today?

- Plotly
- Python
- Logical reasoning
- Physics

How did we DO the activities?

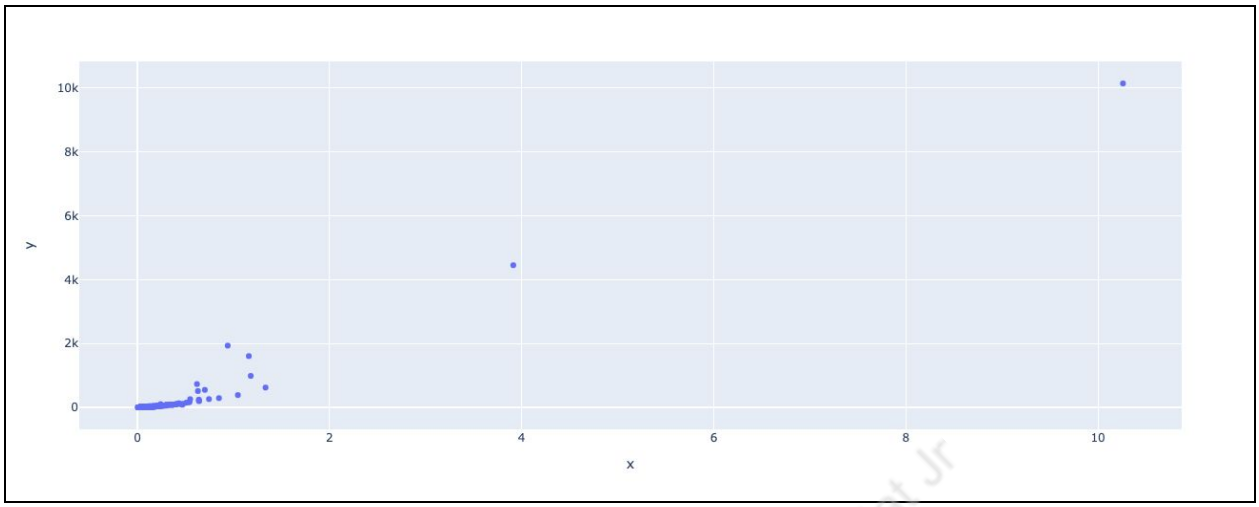
1. Let's check the headers of our data **print(headers)**
2. Look at the columns **orbital_radius and orbital_period:**
   - **Orbital Radius - It is the distance of the planet from the host star.**
   - **Orbital Period - It is the time the planet takes to complete one orbit around its sun.**
3. We notice the 9th column has Planet radius in AU and the orbital period is in either Days or Years.
4. **AU is short for Astronomical Unit** which is roughly the distance between the Sun and the Earth.
   1 AU = 1.496e+8
5. We convert the Years unit to Days for Orbital Period (by multiplying it with 365).
6. We remove the rows that have unknown values in these columns.
7. We plot the chart after converting Years and Days to Days in Float and we also remove the keyword **AU** from the 9th Column (element on index 8). We are then plotting a scatter plot for the same.

```
temp_suitable_planets = list(suitable_planets)
for planet_data in temp_suitable_planets:
 if planet_data[8].lower() == "unknown":
   suitable_planets.remove(planet_data)

for planet_data in suitable_planets:
 if planet_data[9].split(" ")[1].lower() == "days":
   planet_data[9] = float(planet_data[9].split(" ")[0]) #Days
 else:
   planet_data[9] = float(planet_data[9].split(" ")[0])*365 #Years
 planet_data[8] = float(planet_data[8].split(" ")[0])

orbital_radiuses = []
orbital_periods = []
for planet_data in suitable_planets:
 orbital_radiuses.append(planet_data[8])
 orbital_periods.append(planet_data[9])

fig = px.scatter(x=orbital_radiuses, y=orbital_periods)
fig.show()
```



8. We call this the **Goldilock Zone.** Goldilock Zone is the habitable zone where the planet is more likely to have just the right conditions to sustain life.
9. For us, we are at the very beginning of the Goldilock Zone whereas Mars is at the end of it.
10. Earth is 1AU from the Sun and Mars is 1.5AU from the Sun.
11. Some studies suggest on average, any planet that lies within 0.38 - 2 AU is likely to be habitable.
12. Filter out the planets that are not in the Goldilock zone.

```
goldilock_planets = list(suitable_planets) #We will leave suitable planet list as it is

temp_goldilock_planets = list(suitable_planets)
for planet_data in temp_goldilock_planets:
 if planet_data[8] < 0.38 or planet_data[8] > 2:
   goldilock_planets.remove(planet_data)

print(len(suitable_planets))
print(len(goldilock_planets))
```

13. The list of suitable planets gives us 696 and out of those, only 25 are in Goldilock Zone! That's how rare it is! We are really lucky to have Earth!
14. Earth travels at the speed of 30km/s when revolving around the moon.
15. To calculate an exo-planet's speed, we do distance/time.

16. We know the time it takes and we also know the radius of the orbit. Using the formula to find the circumference of a circle, we can find out the distance and the speed of the planet!

    Circumference of a circle - 2πr

    π = 3.14
    r = radius of the orbit

17. Our Earth revolves around the sun at 30km/s. Similarly, our solar system revolves around the center of the Milky Way galaxy at the speed of 200km/s.
18. You can only imagine how fast we are moving! Given this data, we can assume that if a planet revolves at the speed of 200km/s, we can survive that. We are already surviving such high speeds!
19. Also, make sure that we have the orbital_period in days. We need to convert it into seconds because we want to calculate the speed of the planet in **km/s** which is kilometers per second, instead of kilometers per day.

    1 Day = 86400 Seconds

    We also need to convert our orbital radius from AU to KM.

    1 AU = 1.496e+8

    Filter out the planets that have speed
    more than 200km/s.

```
planet_speeds = []
for planet_data in suitable_planets:
 distance = 2 * 3.14 * (planet_data[8] * 1.496e+9)
 time = planet_data[9] * 86400
 speed = distance / time
 planet_speeds.append(speed)

speed_supporting_planets = list(suitable_planets) #We will leave
suitable planet list as it is

temp_speed_supporting_planets = list(suitable_planets)
for index, planet_data in enumerate(temp_speed_supporting_planets):
 if planet_speeds[index] > 200:
```

```
    speed_supporting_planets.remove(planet_data)

print(len(speed_supporting_planets))
```

20. We find out that there are only 8 planets who can support us in terms of speed.

What's NEXT?

In the next class, We will merge the two lists, have a look at our own solar system, explore more factors that can make life possible on an exo-planet, etc.

EXTEND YOUR KNOWLEDGE:

You can read the following blog on speed of our planet to understand more:
https://www.space.com/33527-how-fast-is-earth-moving.html