[Internet Traffic Threat Classification Using a Supervised Spiking Neural Network]

< Felipe Castro
11796909 >

}

Conteúdo da ‘Apresentação’ {

01 Contexto geral

< Ideia geral do método e do problema que me propus a resolver >

02 Projeto do Experimento

< Pré-processamento e hiperparâmetros >

03 Resultados

< O que foi prometido, o que foi realizado e discussões sobre >

}

general_context.py

abstract.html

01 {

[Contexto Geral]

< Ideia geral do método e do problema que me propus a resolver >

}

O que eu pretendo fazer? {

< Meu objetivo é **reproduzir as técnicas** utilizadas nesse estudo e aplicá-las a um **novo conjunto de dados dentro do mesmo domínio**, explorando sua eficácia em um cenário diferente, neste caso a detecção de ameaças em tráfego de internet.>

}

Fonte da imagem: istockphoto.com

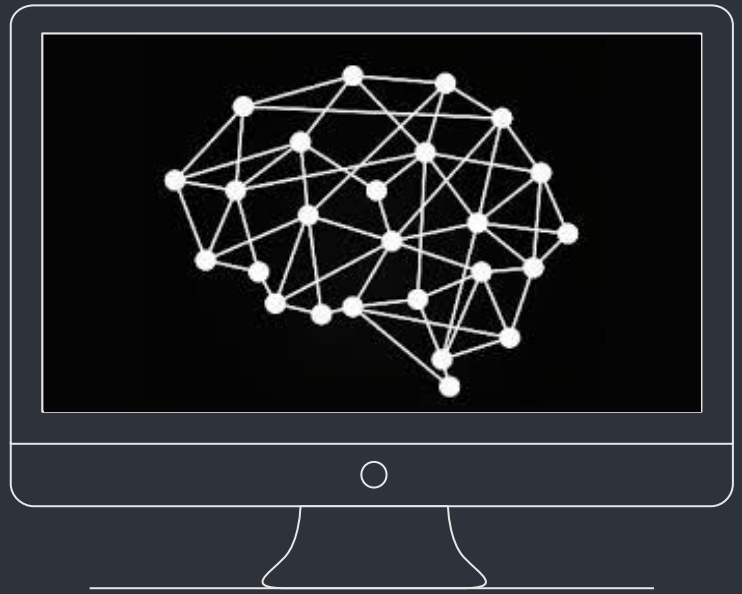
datasets.csv

model_architecture.py

Spinking Neural Networks {

Diferente das redes neurais convencionais, que usam operações matemáticas contínuas, as SNNs processam dados através de picos de ativação (spikes), simulando neurônios biológicos.

}



Fonte da imagem: pngtree.com

structure.html

datasets.csv

CIC-Darknet2020 {

< Conjunto de dados contendo tráfego de Internet oriundo da darknet. Não foi utilizado, pois não continha a captura de pacote trafegados na rede. >

}

Intrusion detection evaluation dataset (CIC-IDS2017) {

< Conjunto de dados focado em tipos de ataques simulados realizados contra um servidor. Foi utilizado, pois continha uma boa variedade de ataques, além da captura de pacotes preservada. >

}

research.py

structure.html

02 {

[Projeto do Experimento]

< Pré-processamento e hiperparâmetros >

}

datasets.csv

data.pcap

Leitura dos ‘PCAPs’{

}

	timestamp	IP_version	IP_ihl	IP_tos	IP_len	IP_id	IP_flags	IP_frag	IP_ttl	IP_proto	IP_chksum	IP_src
0	1433356821.839550	4	5	0	162	20629	DF	0	107	6	53743	205.188.12.91
1	1433356821.839658	4	5	0	40	52142	DF	0	64	6	33360	10.8.8.178
2	1433356822.479111	4	5	0	338	21179	DF	0	107	6	53017	205.188.12.91
3	1433356822.479913	4	5	0	40	52143	DF	0	64	6	33359	10.8.8.178
4	1433356822.680985	4	5	0	162	21344	DF	0	107	6	53028	205.188.12.91

IP_dst	IP_options	TCP_sport	TCP_dport	TCP_seq	TCP_ack	TCP_dataofs	TCP_reserved
10.8.8.178	[]	443.0	48911.0	3.987076e+09	2.730303e+09	5.0	0.0
205.188.12.91	[]	48911.0	443.0	2.730303e+09	3.987076e+09	5.0	0.0
10.8.8.178	[]	443.0	48911.0	3.987076e+09	2.730303e+09	5.0	0.0
205.188.12.91	[]	48911.0	443.0	2.730303e+09	3.987077e+09	5.0	0.0
10.8.8.178	[]	443.0	48911.0	3.987077e+09	2.730303e+09	5.0	0.0

Tipos de ‘Ameaça’ {

- **Botnet** — Redes de computadores infectados (bots) controlados remotamente para realizar atividades maliciosas.
- **Exploit** — Ataques direcionados a aplicações web, explorando vulnerabilidades como XSS (Cross-Site Scripting) e SQL Injection.
- **Infiltration** — Ataques que simulam a introdução de malware na rede interna, por meio de dispositivos USB infectados ou downloads maliciosos.

}

Rotulando ‘Ameaças’ {

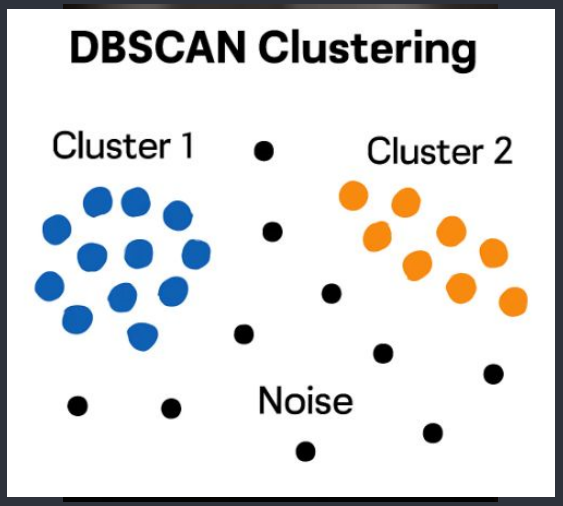
```
attack_schedule = {
    datetime(2017, 7, 3).date(): [],  # Benign traffic only

    datetime(2017, 7, 4).date(): [
    ],

    datetime(2017, 7, 5).date(): [
        {"type": "Exploit","src": "205.174.165.73","dst": "205.174.165.66", "start": time(15, 12), "end": time(15, 32)},
    ],

    datetime(2017, 7, 6).date(): [
        {"type": "Exploit", "src": "205.174.165.73", "dst": "192.168.10.8", "start": time(14, 19), "end": time(14, 35)},
        {"type": "Infiltration",  "src": "205.174.165.73", "dst": "192.168.10.25", "start": time(14, 53), "end": time(15, 0)},
        {"type": "Infiltration",   "src": "205.174.165.73", "dst": "192.168.10.8",  "start": time(15, 4),  "end": time(15, 45)},
    ],

    datetime(2017, 7, 7).date(): [
        {"type": "Botnet", "src": "205.174.165.73", "dst": "192.168.10.8",  "start": time(10, 2), "end": time(11, 2)},
        {"type": "Infiltration",    "src": "205.174.165.73", "dst": "205.174.165.68", "start": time(13, 55), "end": time(15, 29)},
    ]
}
```

}

Undersampling ‘caso benignos’ {

< Com o objetivo de reduzir a quantidade de casos de tráfego benigno, eu utilizei o DBScan para agrupar os casos mais semelhantes e eleger um representante do grupo para passar para a etapa de modelagem.>

}



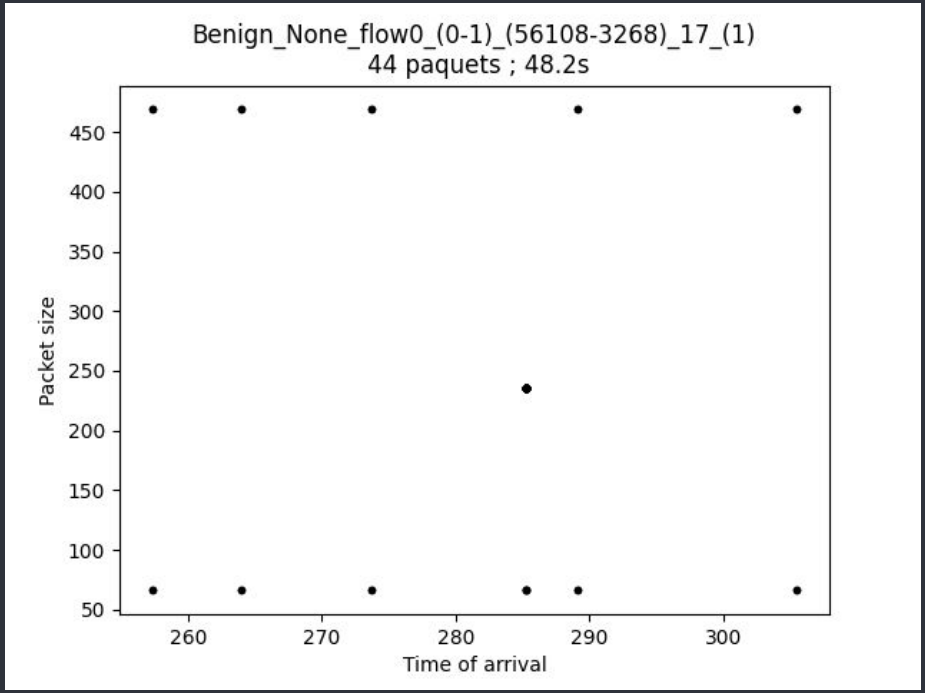
Fonte da imagem:
upgrad.com/blog/what-is-dbscan-clustering/

data.pcap

histo.png

Tratamento dos ‘PCAPs’{

}



Seleção de
‘Hiperparâmetros’
{ Via Optuna
|
}

OPTUNA

Hiperapâmetros ajustáveis; {

```
nb_epochs: [5, 7, 10]
warmup_epochs: [1, 2, 4]
snapshot_epochs: [[2,5],[5,10]]

beta_init_method: [constant]
beta_constant_val: [0.5, 0.7, 0.9]
beta_normal_mean: [0.6, 0.7]
beta_normal_std: [0.01, 0.05]
```

```
nb_dense_layer: [25, 50, 100]
nb_outputs: [14]

w_init_mean: [0, 0.01]
w_init_std: [0.05, 0.1, 0.15, 0.2]

nb_steps: [300]
weight_decay: [0.0001, 0.001]
betas: [[0.9, 0.999], [0.85, 0.995], [0.95, 0.98]]
time_step: [0.001]
gamma: [0.85, 0.9, 0.95]
eps: 0.00000001
Max_spikes_per_run: [1, 2, 3]
```

}

Hiperapâmetros ajustados; {

```
nb_epochs: 10
warmup_epochs: 2
snapshot_epochs: [5, 10]
lateral_connections: false
Regularization_Term:
- squared
- max

lr: 0.0005

beta_uniform_start: 0.0
beta_uniform_end: 1.0
```

```
nb_dense_layer: 78
nb_outputs: 4
w_init_mean: 0
w_init_std: 0.15
surrogate_sigma_sigmoid: 10
surrogate_sigma_rec: 1
surrogate_a_fast_sigmoid_abs: 0.5
surrogate_a_fast_sigmoid_tanh: 0.5
surrogate_sigma_scale: 1.0
nb_steps: 300
weight_decay: 0.001
betas:
- 0.9
- 0.999
time_step: 0.001
gamma: 0.9
eps: 1.0e-08
```

}

03 {

[Resultados]

< O que foi prometido, o que foi realizado e discussões sobre >

}

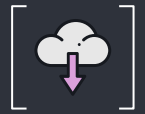
Avaliação; {

Acurácia

< Medida geral de quanto o modelo acerta >

Revocação

< Capacidade do modelo de não deixar de retornar a classe correta, evitando falsos negativos >



Precisão

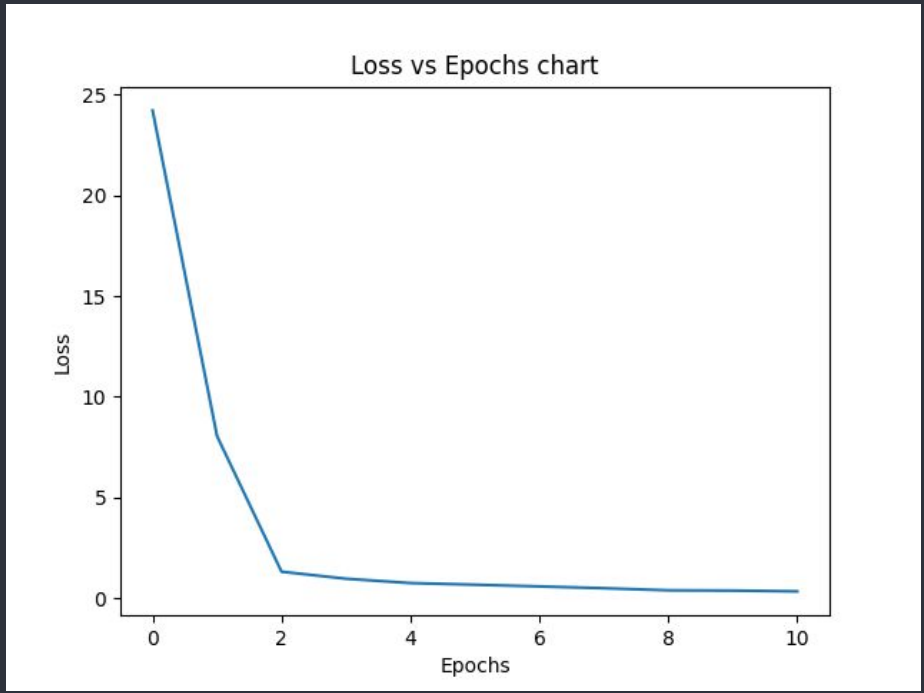
< Medida de quanto o modelo retorna a classe correta com maior especificidade, evitando falsos positivos >

}

results.py

evaluation.py

Avaliação; {

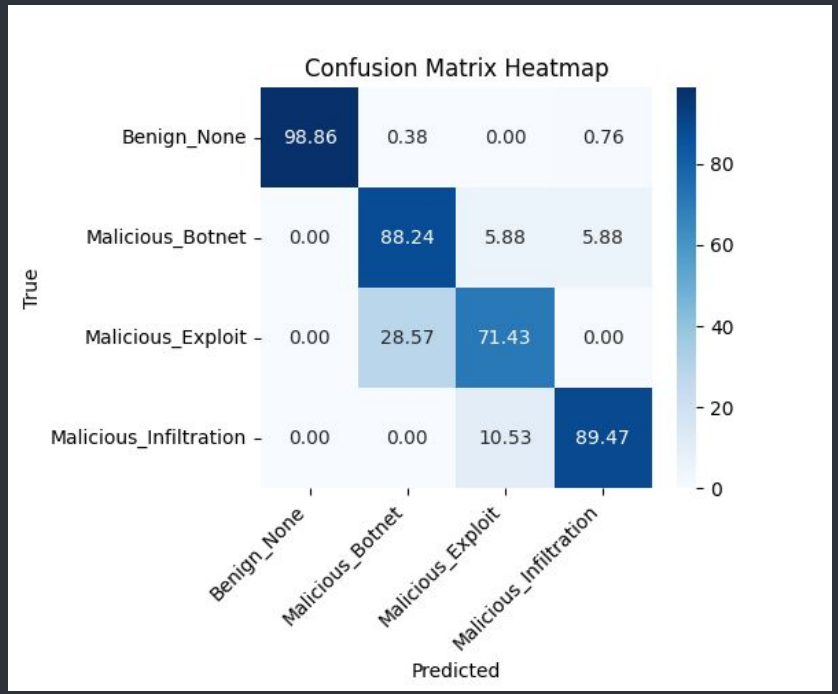


}

results.py

evaluation.py

Avaliação; {



}

results.py

evaluation.py

Avaliação; {

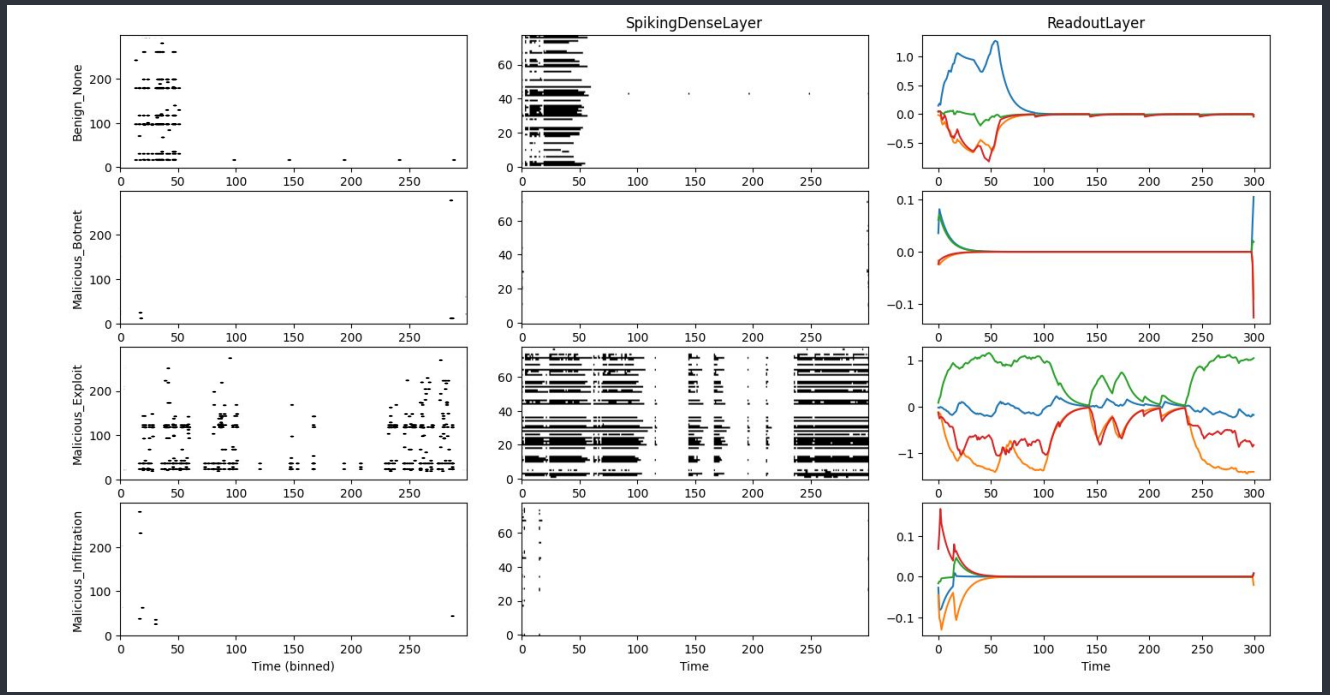
```
Benign_None (0) : Re = 100.0% ; Pr = 98.9% ; Ac = 99.0%
Malicious_Botnet (1) : Re = 83.3% ; Pr = 88.2% ; Ac = 98.4%
Malicious_Exploit (2) : Re = 62.5% ; Pr = 71.4% ; Ac = 98.4%
Malicious_Infiltration (3) : Re = 85.0% ; Pr = 89.5% ; Ac = 98.4%
```

}

results.py

evaluation.py

Avaliação; {



}

Referência do Artigo {

Ali Rasteh, Florian Delpech, Carlos Aguilar-Melchor, Romain Zimmer, Saeed Bagheri Shouraki, Timothée Masquelier,

Encrypted internet traffic classification using a supervised spiking neural network,

Neurocomputing:
* Volume 503,
* 2022,
* Pages 272-282,
* ISSN 0925-2312,

DOI:
* https://doi.org/10.1016/j.neucom.2022.06.055.

}

thanks.c

```
1
2
3
4
5
6
7
8
9
10
11
12
13
14
```

```
Muito {
Obrigado;

}
```


slidesgo

Concepts < /1 > {

< Mercury is the closest planet to the Sun and the smallest one in the Solar System—it's only a bit larger than the Moon >

}

Concepts < /2 > {

< Venus has a beautiful name and is the second planet from the Sun. It's hot and has a poisonous atmosphere >

}

forbeginners.html

workshop.css

```
Introduction; {

    ‘Here you can give a brief description of the
    topic you want to talk about’

        <p For example, if you want to talk about
        Mercury, you can say that it’s the smallest
        planet in the entire Solar System >

        </p>

}
```

forbeginners.html

workshop.css

What Is this ‘Topic About ?’ {

Languages

Html 60%

< Mercury is the smallest planet in the entire Solar System >

Css 40%

< The Earth is the only one that harbors life in the Solar System >

Create a web page

Venus has a nice name

Mars is a cold place

Jupiter is a gas giant

}

Programming Language

Features of ‘the Topic’ {

- **Step 01** Mercury is the closest planet to the Sun and the smallest one
- **Step 02** Saturn is a gas giant and has several rings
- **Step 03** The Earth is the only planet that harbors life
- **Step 04** Venus has a beautiful name and is the second planet from the Sun

}

Recommendations; {

Mercury

< Mercury is the closest planet to the Sun and the smallest one in the Solar System >

Saturn

< It was named after the Roman god of wealth and agriculture >

Jupiter

< Jupiter is a gas giant and the biggest planet in the Solar System >

}

Examples About ‘The Topic’{

Mercury

< Mercury is the closest planet to the Sun >

Jupiter

< Jupiter is a gas giant and the biggest planet >

Saturn

< Saturn is a gas giant and has several rings >

Venus

< Venus has a nice name and high temperatures >

}

forbeginners.html

workshop.css

Practical Exercise {

< Saturn is the fourth-largest object by diameter in the Solar System >

< /1 >

* Mercury is the smallest planet
* The Earth is the planet we live on
* Saturn is made of oxygen and helium

< /2 >

* Jupiter is a gas giant
* Venus has high temperatures
* Neptune is very far away from the Sun

}

Programming Language

forbeginners.html

workshop.css

```
9h 55m 23s {
    < Is Jupiter's rotation period >

    333,000.000
    < Earths fit in the Sun’s mass >

    386,000 km
    < Distance between the Moon and the Earth >
}
```

Programming Language

A ‘Picture’ Is {
Worth a Thousand
Words

}

OPTUNA

forbeginners.html

workshop.css

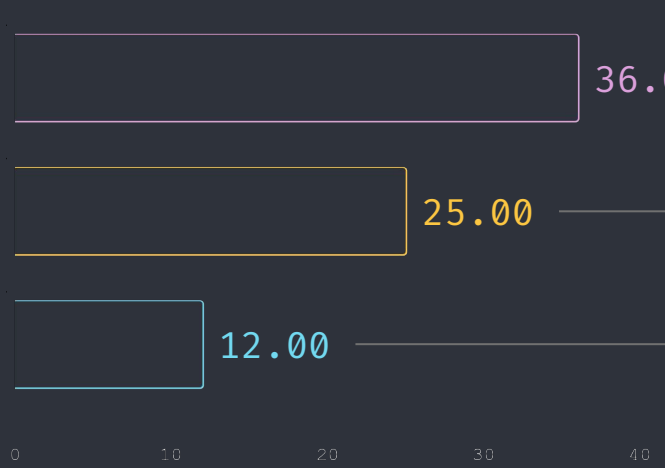
```
Awesome {
Words;

}
```

Programming Language

forbeginners.html

workshop.css

Did You Know ‘This ?’ {



Mercury is the smallest planet of the Solar System

Venus has a beautiful name and high temperatures

Despite being red, Mars is actually a cold place

}

Follow the link in the graph to modify its data and then paste the new one here. **For more info, click here**

A ‘Picture’ Always Reinforces The Concept {

> < Images reveal large amounts of data, so remember: use an image instead of a long text. Your audience will appreciate it >

}

forbeginners.html

workshop.css

```
150,005,630 {
    < Big numbers catch your audience's attention >
}
```

Programming Language

forbeginners.html workshop.css

```
1
2
3
4
5
6
7
8
9
10
11
12
13
14
```

< “This is a quote, words full of wisdom that someone important said and can make the reader get inspired.” >

— Someone ‘Famous’

Programming Language

forbeginners.html

workshop.css

Review ‘Concepts’ {

< Mercury is the closest planet to the Sun and the smallest one in the Solar System >

- Venus
- Ceres
- Saturn

}

forbeginners.html

workshop.css

Planning of ‘September’{

M	T	W	T	F	S	S	
		01	02	03	04	05	Mercury is the smallest planet
06	07	08	09	10	11	12	Venus has a beautiful name
13	14	15	16	17	18	19	The Earth is the third planet
20	21	22	23	24	25	26	Mars is actually a cold place
27	28	29	30				Jupiter is a gas giant

}

forbeginners.html

workshop.css

JavaScript For ‘Beginners’ {

Mercury

It is the closest planet to the Sun

Mars

Despite being red, Mars is a cold place

Jupiter

Jupiter is the biggest planet

Venus

Venus is the second planet from the Sun

Saturn

Saturn is a gas giant and has several rings

Neptune

Neptune is very far from the Earth

}

Programming Language

forbeginners.html

workshop.css

Desktop Software {

You can replace the image on the screen with your own work. Just delete this one, add yours and center it properly

}

Thanks; {

‘Do you have any questions?’

youremail@freepik.com
+91 620 421 838
yourcompany.com

}

Web ‘Design’

Alternative ‘Resources’ {

Here’s an assortment of alternative resources
whose style fits the one of this template

Photos:

* Portrait hacker I
* Portrait hacker II

}

Resources {

Did you like the resources on this template? Get them for free at our other websites:

Photos:

* Close up hacker
* Medium shot woman working computer

Icons:

* Web design

}

Instructions for use

In order to use this template, you must credit **Slidesgo** by keeping the **Thanks** slide.

You are allowed to:

- Modify this template.
- Use it for both personal and commercial projects.

You are not allowed to:

- Sublicense, sell or rent any of Slidesgo Content (or a modified version of Slidesgo Content).
- Distribute Slidesgo Content unless it has been expressly authorized by Slidesgo.
- Include Slidesgo Content in an online or offline database or file.
- Offer Slidesgo templates (or modified versions of Slidesgo templates) for download.
- Acquire the copyright of Slidesgo Content.

For more information about editing slides, please read our FAQs or visit Slidesgo School:

https://slidesgo.com/faqs and https://slidesgo.com/slidesgo-school

Instructions for use (premium users)

As a Premium user, you can use this template without attributing **Slidesgo** or keeping the "Thanks" slide.

You are allowed to:

- Modify this template.
- Use it for both personal and commercial purposes.
- Hide or delete the “Thanks” slide and the mention to Slidesgo in the credits.
- Share this template in an editable format with people who are not part of your team.

You are not allowed to:

- Sublicense, sell or rent this Slidesgo Template (or a modified version of this Slidesgo Template).
- Distribute this Slidesgo Template (or a modified version of this Slidesgo Template) or include it in a database or in any other product or service that offers downloadable images, icons or presentations that may be subject to distribution or resale.
- Use any of the elements that are part of this Slidesgo Template in an isolated and separated way from this Template.
- Register any of the elements that are part of this template as a trademark or logo, or register it as a work in an intellectual property registry or similar.

For more information about editing slides, please read our FAQs or visit Slidesgo School:

https://slidesgo.com/faqs and https://slidesgo.com/slidesgo-school

Fonts & colors used

This presentation has been made using the following fonts:

Fira Code
(https://fonts.google.com/specimen/Fira+Code)

Storyset

Create your Story with our illustrated concepts. Choose the style you like the most, edit its colors, pick the background and layers you want to show and bring them to life with the animator panel! It will boost your presentation. Check out How it Works.

Pana

Amico

Bro

Rafiki

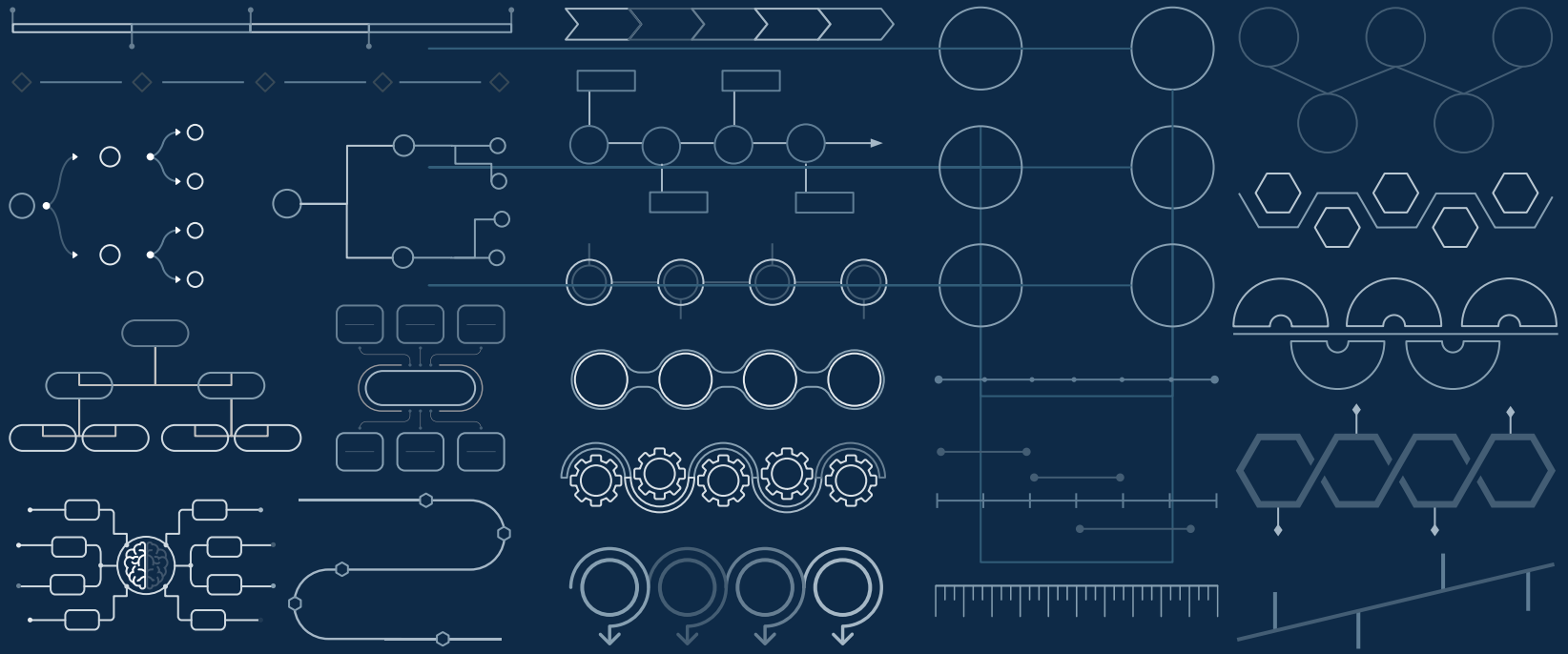
Cuate

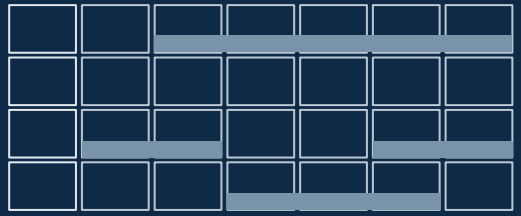
Use our editable graphic resources...

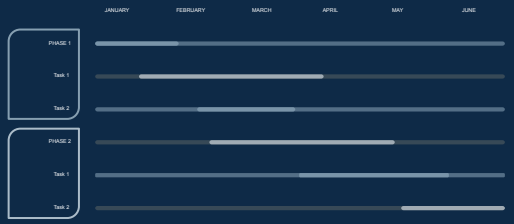
You can easily resize these resources without losing quality. To change the color, just ungroup the resource and click on the object you want to change. Then, click on the paint bucket and select the color you want. Group the resource again when you're done. You can also look for more infographics on Slidesgo.

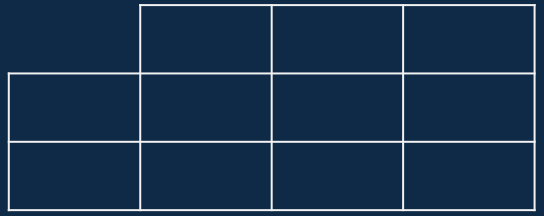


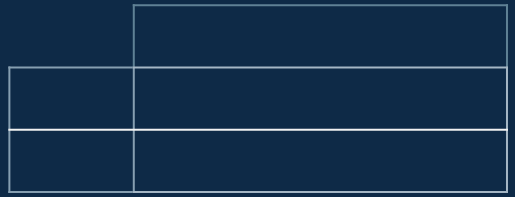


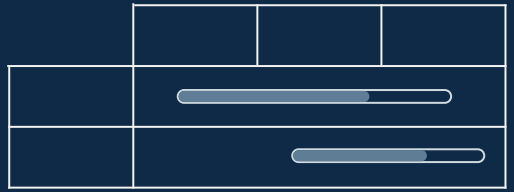



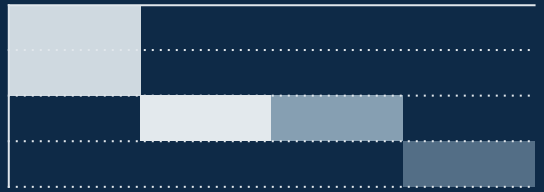


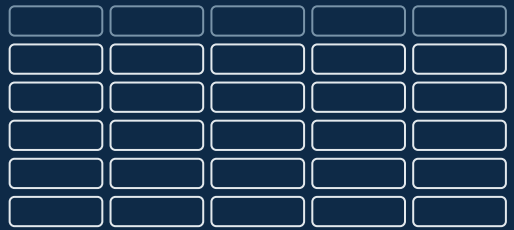

JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
PHASE 1
Task 1
Task 2
PHASE 2
Task 1
Task 2

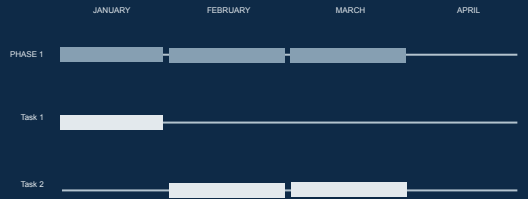


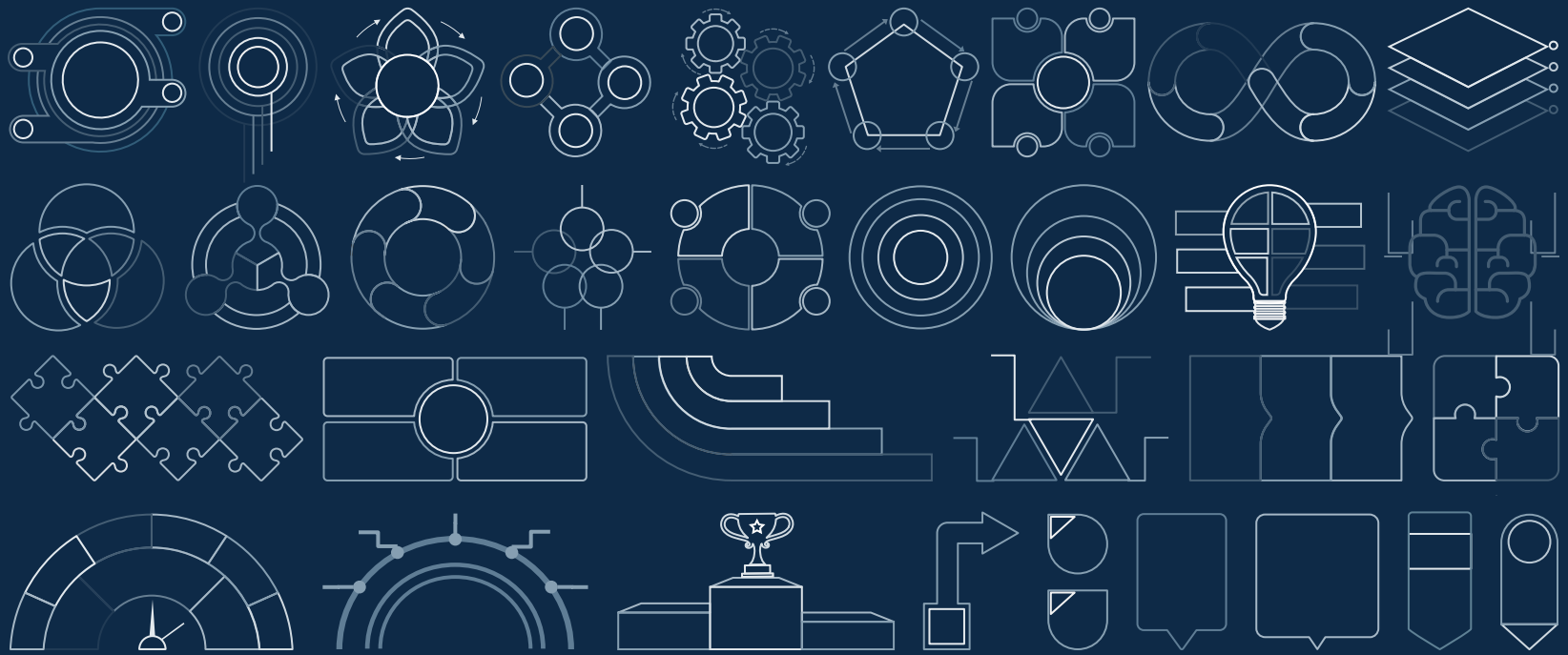


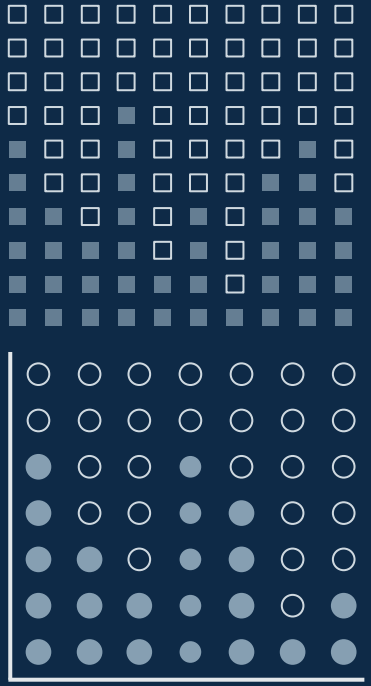







JANUARY
FEBRUARY
MARCH
APRIL
PHASE 1
Task 1
Task 2





...and our sets of editable icons

You can resize these icons without losing quality.
You can change the stroke and fill color; just select the icon and click on the paint bucket/pen.
In Google Slides, you can also use Flaticon's extension, allowing you to customize and add even more icons.

Educational Icons

Medical Icons

Business Icons

Teamwork Icons

Help & Support Icons

Avatar Icons

Creative Process Icons

Performing Arts Icons

Nature Icons

SEO & Marketing Icons


slidesgo