

Apresentação do Método { [Spiking Neural Networks]

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}

Conteúdo da 'Apresentação' {

01 Contexto Geral

< Ideia geral do que é esse tipo de Rede Neural Artificial >

02 Arquitetura do Neurônio (LIF)

< Processamento da entrada, memória e propagação da informação >

03 Arquitetura da Rede

< Formato da rede, feed forward e backpropagation >

04 Conclusão

< Vantagens do método no problema selecionado >

}

01 {

[Contexto Geral]

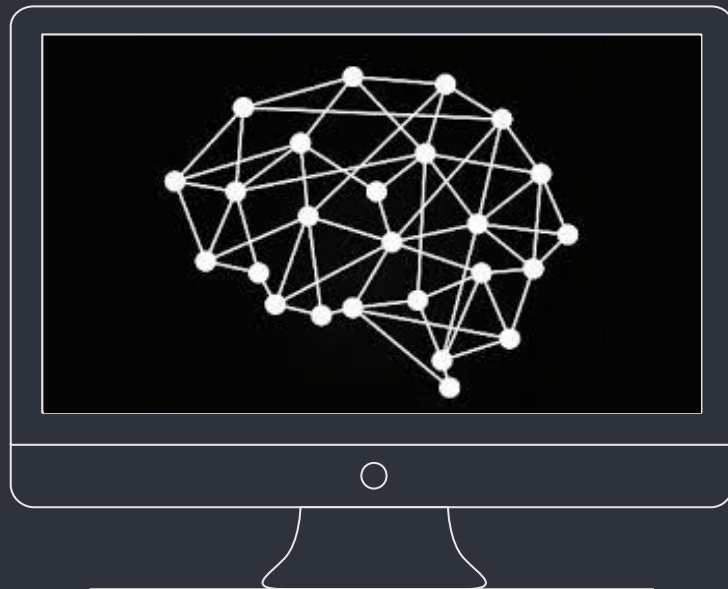
< Ideia geral do que é esse tipo
de Rede Neural Artificial >

}

Spiking 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

Modelagem temporal natural {



< Ao invés de usar uma sequência "plana" de dados, como numa MLP ou CNN, a SNN processa eventos no tempo, como o tráfego de rede >

}

Eficiência energética e computacional {



< SNNs ativam neurônios somente quando há spikes, ou seja, sob demanda >

}

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02 {

[Arquitetura do Neurônio (LIF)]

< Conjunto de dados, pré-processamento
e medidas de avaliação >

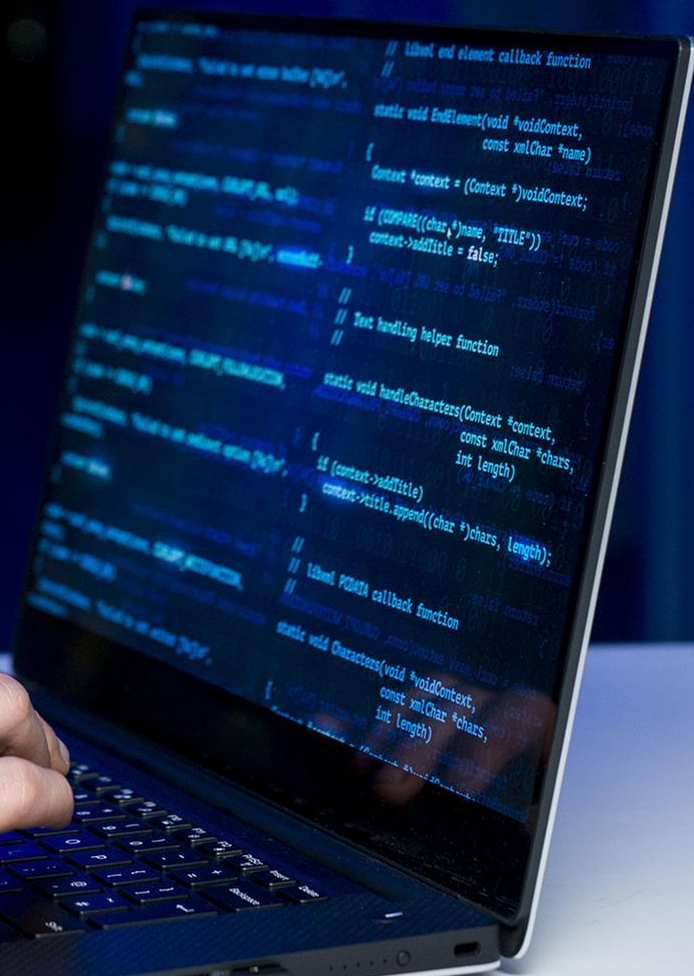
}

Neurônio do tipo

'LIF' {

Como é a sua
arquitetura?

}



Etapas do processamento; {



Potencial da Membrana (Memória)

< Potencial elétrico acumulado da membrana do neurônio >



Pulso (Spike)

< Propagação da informação na forma de um pulso para a próxima camada >




Reset de Memória

< Atualização do Potencial da membrana após o pulso (spike) >

}

Potencial da Membrana (Memória) {

 **Memória do Neurônio**

$$U_i^{(\ell)}[t+1] = \beta U_i^{(\ell)}[t] + I_i^{(\ell)}[t] - S_i^{(\ell)}[t]$$

$U_i^{(\ell)}$ = Potencial elétrico da Membrana do Neurônio (Memória)
 β = Fator de decaimento (esquecimento)
 $I_i^{(\ell)}$ = Corrente de Entrada do Neurônio
 $S_i^{(\ell)}$ = Ativação do Neurônio (Reset da Memória)

}

Potencial da Membrana (Memória) {



Entrada

$$I_i^{(\ell)}[t+1] = \sum w_{ij}^{(\ell)}[t] S_j^{(\ell-1)}[t]$$

$I_i^{(\ell)}$ = Corrente de Entrada do Neurônio

$w_{ij}^{(\ell)}$ = Pesos Sinápticos

$S_i^{(\ell)}$ = Ativação do Neurônio da Camada Anterior (dados não processados, caso seja a primeira camada)

}

Pulso (Spike) {



Função de Ativação

$$S_i^{(\ell)}[t] \equiv \Phi(U_i^{(\ell)}[t] - U_{thr})$$

$S_i^{(\ell)}$ = Ativação do Neurônio (Pulso/Spike)

Φ = Função de ativação (função passo)

$U_i^{(\ell)}$ = Potencial elétrico da Membrana do Neurônio (Memória)

U_{thr} = Limite de acúmulo da membrana

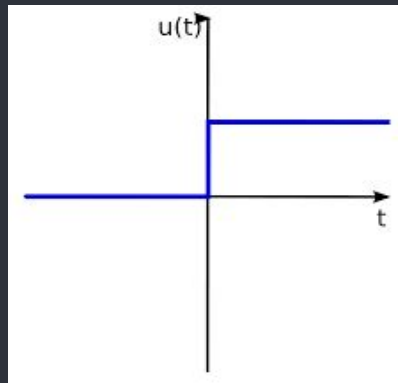
}

Pulso (Spike) {



Função de Ativação

$$S_i^{(\ell)}[t] \equiv \Phi(U_i^{(\ell)}[t] - U_{thr})$$



$S_i^{(\ell)}$ = Ativação do Neurônio (Pulso/Spike)

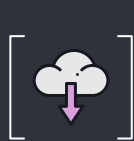
Φ = Função de ativação (função passo)

$U_i^{(\ell)}$ = Potencial elétrico da Membrana do Neurônio (Memória)

U_{thr} = Limite de acúmulo da membrana

}

Reset de Memória {



Função de Reset

$$U_i^{(\ell)}[t+1] = (U_i^{(\ell)}[t] - U_{thr}) \cdot S_i^{(\ell)}[t]$$

- $U_i^{(\ell)}$ = Potencial elétrico da Membrana do Neurônio (Memória)
- U_{thr} = Limite de acúmulo da membrana
- $S_i^{(\ell)}$ = Ativação do Neurônio (Pulso/Spike)
- Φ = Função de ativação (função passo)

}

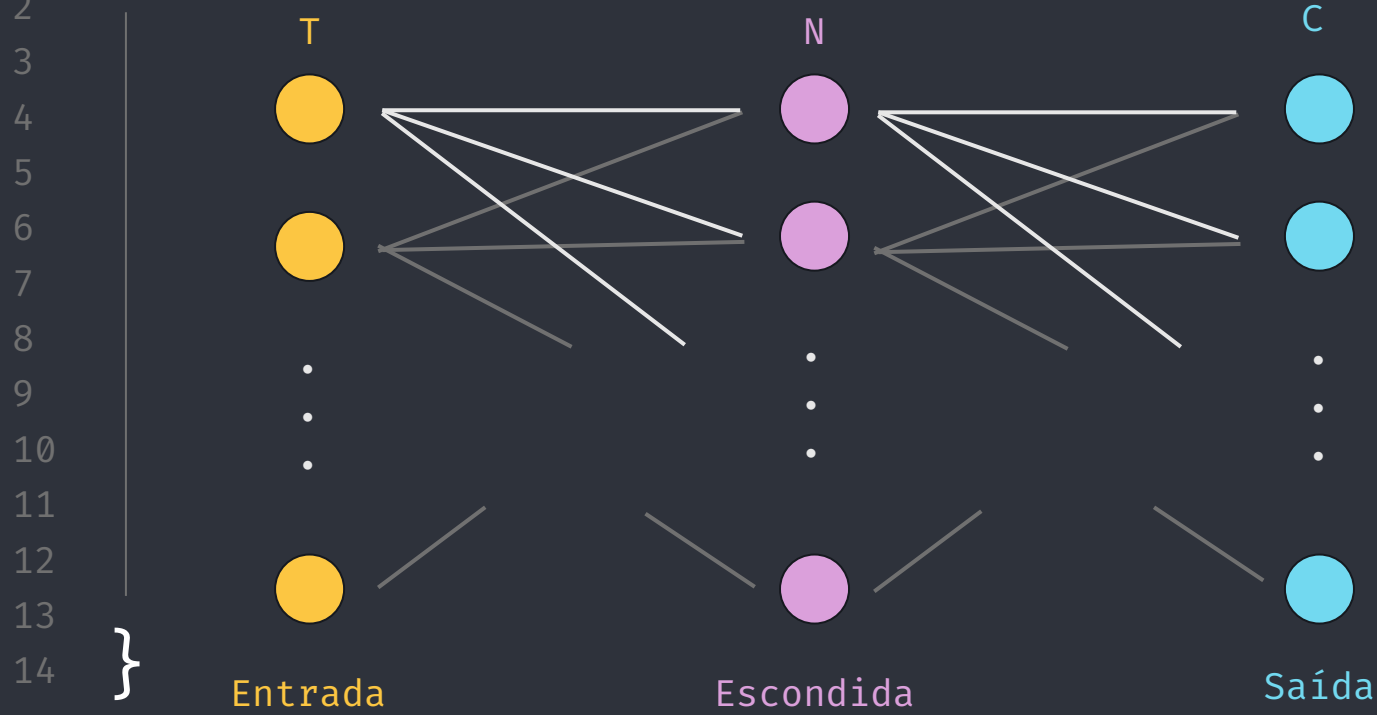
03 {

[Arquitetura da Rede]

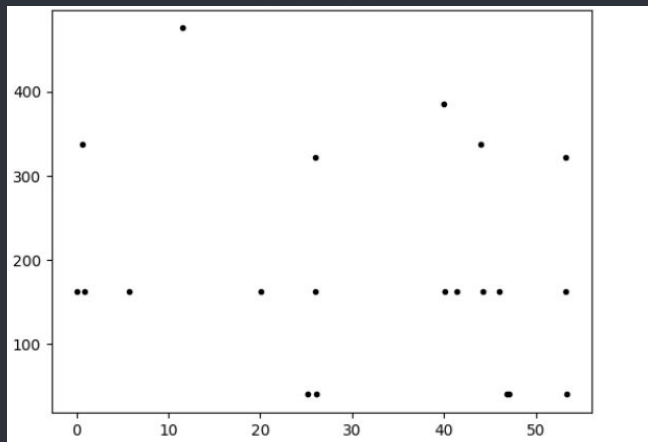
< Formato da rede, feed forward e
backpropagation >

}

Arquitetura da Rede; {



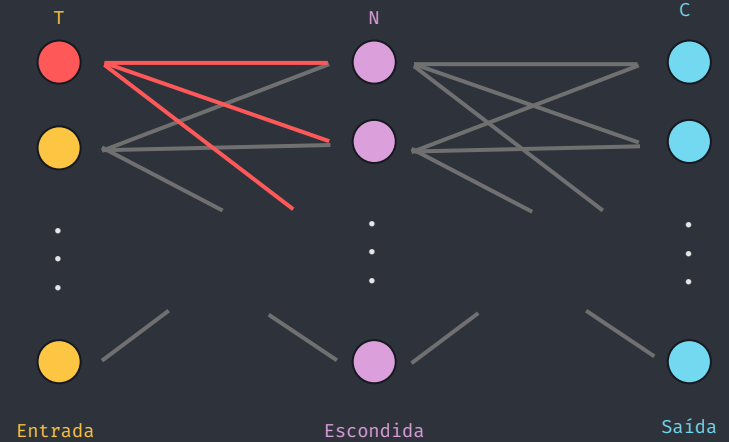
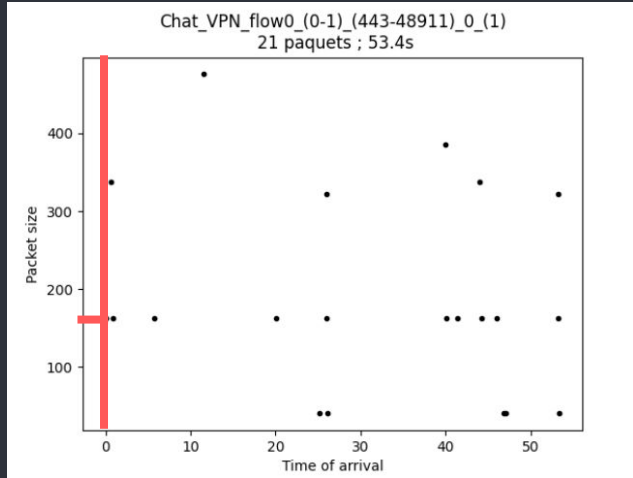
Tipo de Entrada {



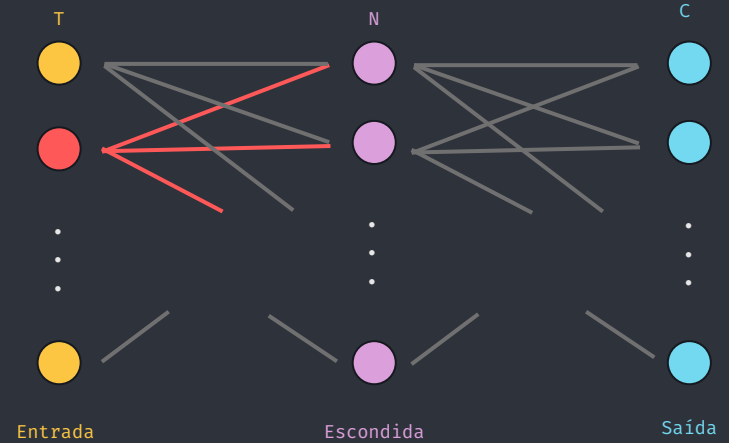
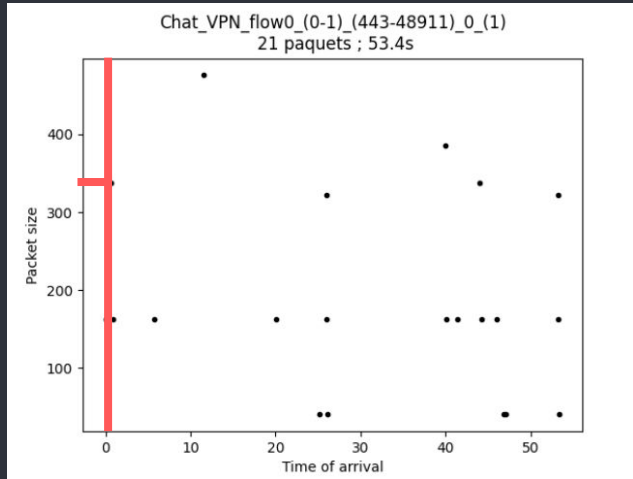
- **1** Variável temporal;
- **1-n** Variáveis **não** temporais.

}

Feed Forward; {

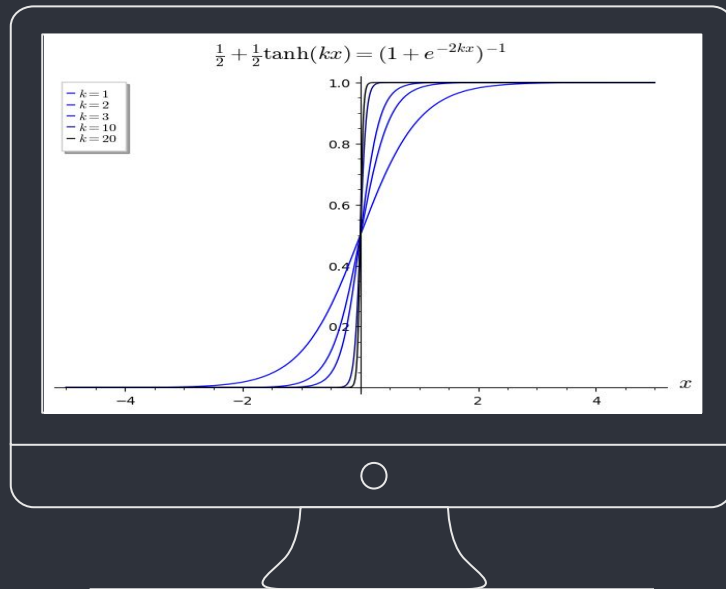


Feed Forward; {



Surrogate Backpropagation

Como a função de ativação (step-function) não é diferenciável, precisamos fazer uso de uma função substituta para calcular o gradiente durante a backpropagation.



Surrogate Backpropagation {

Função Surrogate

$$\frac{U_i^{(\ell)}[t] - U_{thr}}{1 + k|U_i^{(\ell)}[t] - U_{thr}|}$$

Derivada da Surrogate

$$\frac{1}{(1 + k|U_i^{(\ell)}[t] - U_{thr}|)^2}$$

}

04 {

[Conclusão]

< Vantagens do método no problema
selecionado >

}

Modelagem temporal natural {



< Como vimos, a rede possui uma espécie de recorrência em nível de arquitetura de neurônio, o que é particularmente útil para trabalhar com dados temporais >

}

Eficiência energética e computacional {



< Os pulsos discretos e condicionais dos neurônios permitem que apenas parte da rede esteja ativa por vez, tornando-a mais eficiente >

}

thanks.c

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```
Muito {  
Obrigado;  
|  
}
```




```
1 Introduction; {
```

```
2  
3  
4  
5 'Here you can give a brief description of the  
6 topic you want to talk about'
```

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

```
10  
11  
12 </p>
```

```
13  
14 }
```

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

}

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 >

}

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
```

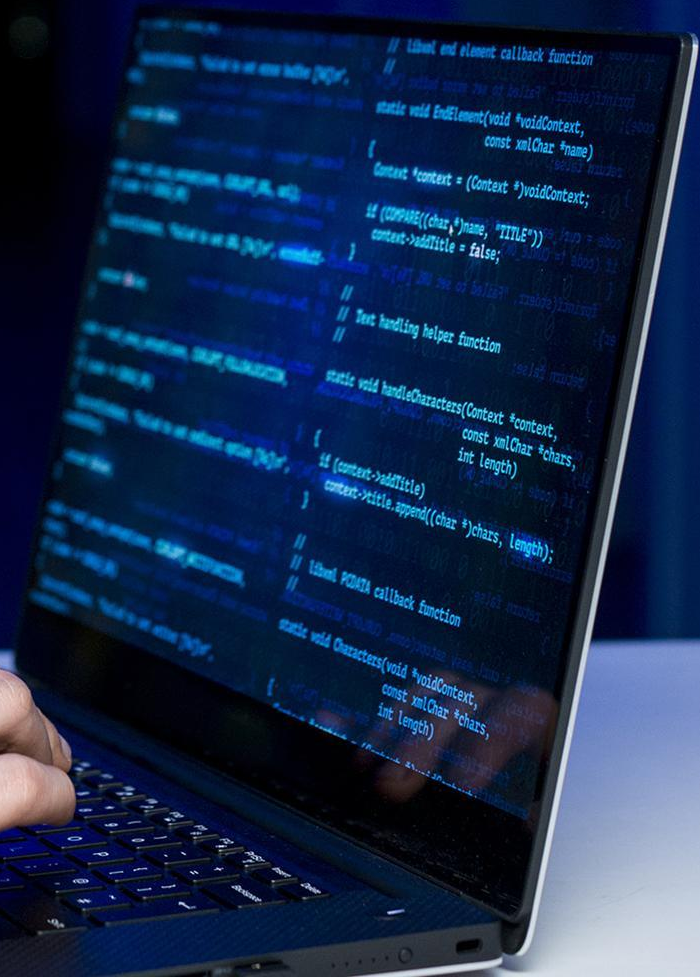
```
< /2 >      * Jupiter is a gas giant  
              * Venus has high temperatures  
              * Neptune is very far away from the Sun
```

```
}
```

```
1 9h 55m 23s {
2
3    < Is Jupiter's rotation period >
4
5
6    333,000.000
7
8    < Earths fit in the Sun's mass >
9
10   386,000 km
11
12   < Distance between the Moon and the Earth >
13 }
14
```

A 'Picture' Is {
Worth a Thousand
Words

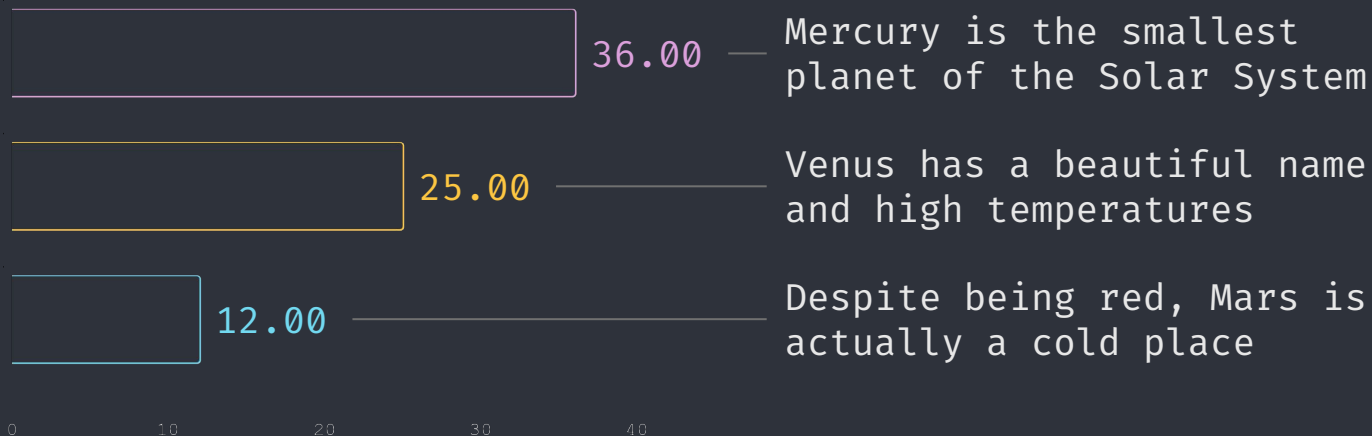
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Awesome {
Words;
|
}

Did You Know 'This ?' {



}

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 >

}



```
1
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4 150,005,630 {
5
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7
8   < Big numbers catch your audience's attention >
9
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10 }
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```
< “This is a quote, words full of  
wisdom that someone important said and  
can make the reader get inspired.” >
```

```
– Someone ‘Famous’
```

Review 'Concepts' {

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

● Venus ● Ceres ● Saturn



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

}

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

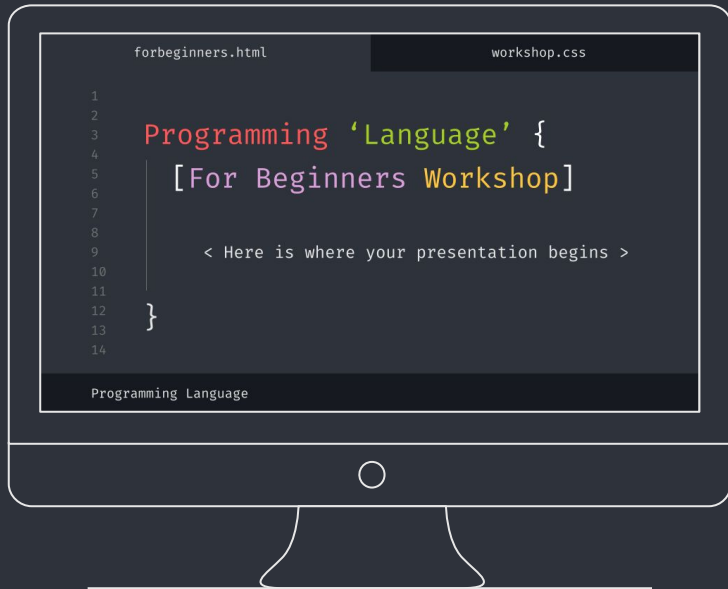
Neptune is very far
from the Earth

}

Desktop Software {

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

}



```
1 Thanks; {
```

```
2  
3 'Do you have any questions?'
```

```
4  
5 youremail@freepik.com
```

```
6 +91 620 421 838
```

```
7 yourcompany.com
```



```
10 CREDITS: This presentation template was  
11 created by Slidesgo, including icons by  
12 Flaticon, and infographics & images by Freepik
```

```
13 < Please keep this slide for attribution >
```

```
14 }
```

forbeginners.html

workshop.css

Web 'Design'



Programming Language

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

}

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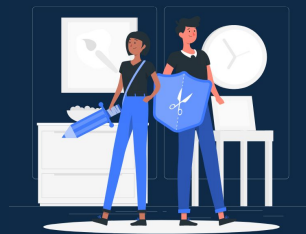
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Amico



Bro



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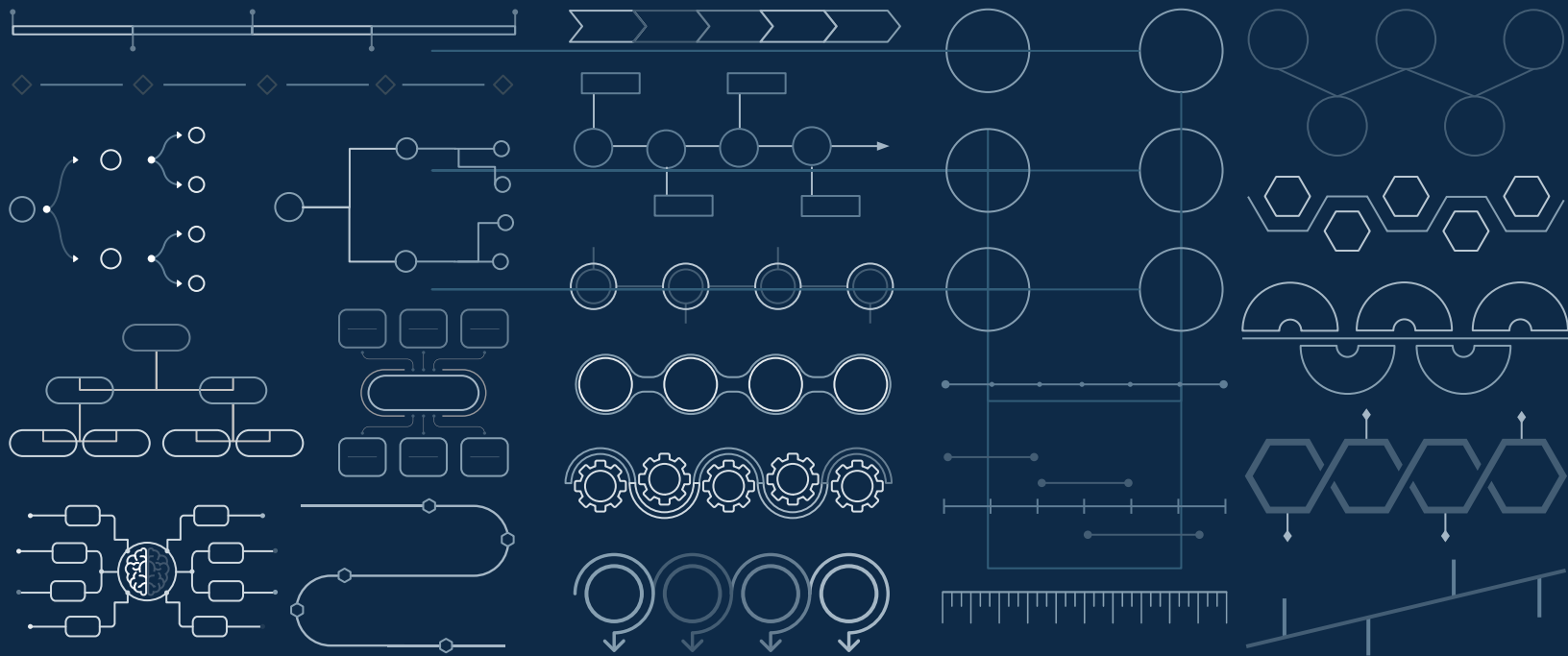
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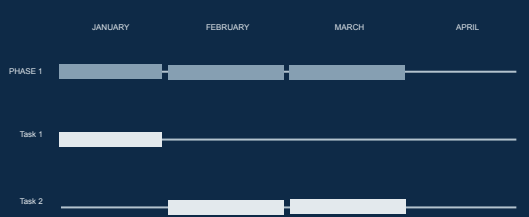
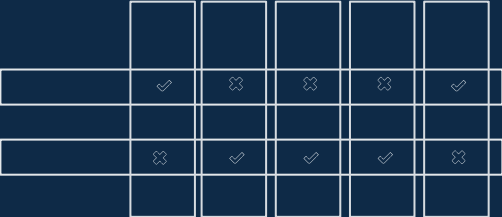
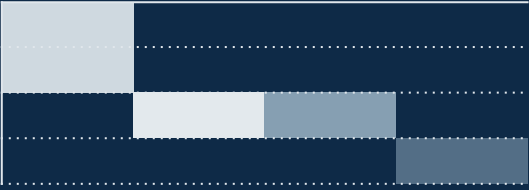
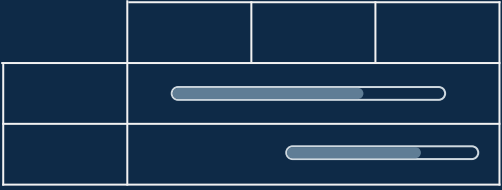
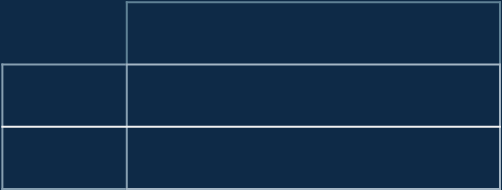
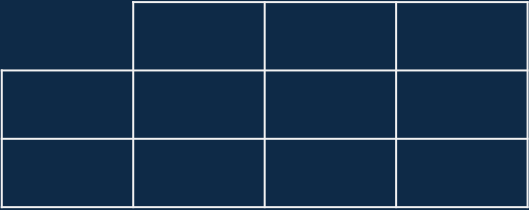
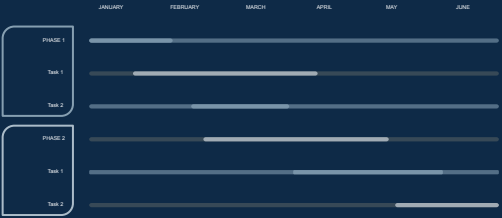
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