

Redes Neuronales Convolutionales: LeNet-5

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1.

INTRODUCCIÓN



LeNet se refiere a LeNet-5 y es una red neuronal convolucional simple.

LeNet-5 fue una de las primeras redes neuronales convolucionales y promovió el desarrollo del deep learning.

Fue propuesto en 1989 por Yann LeCun



Yann LeCun

2. PAPER

Backpropagation Applied to
Handwritten Zip Code Recognition



1
 1011915485726803226414186
 6359720299299722510046701
 3084111591010615406103631
 1064111030475262009979966
 8912056708557131427955460
 2018750187112993089970984
 0109707597331972015519066
 1075318255182814358090963
 1787521655460554603546055
 18255108503067520439401

10 output units

layer H3

30 hidden units

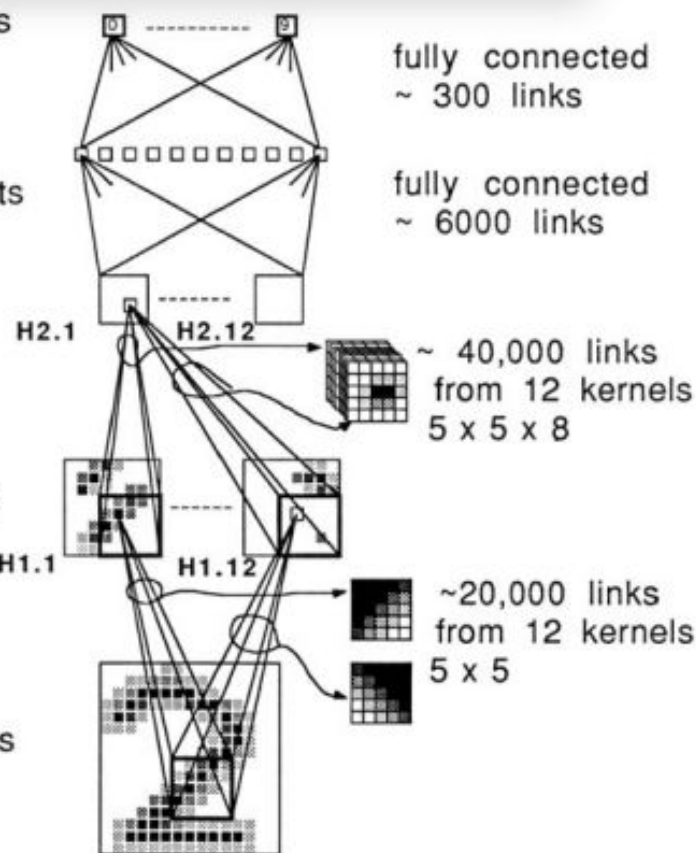
layer H2

12 x 16 = 192
hidden units

layer H1

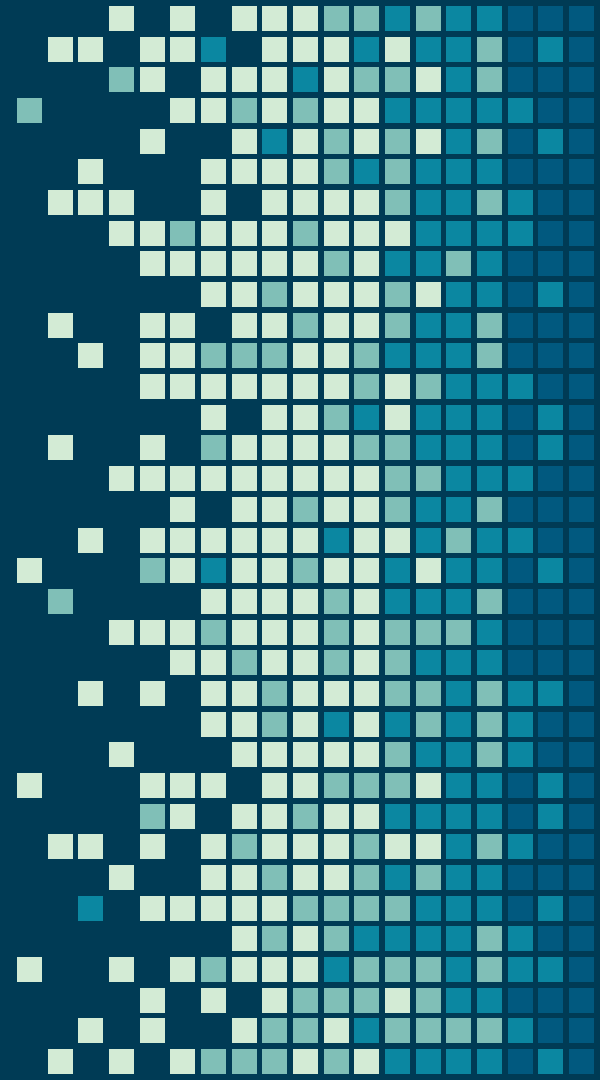
12 x 64 = 768
hidden units

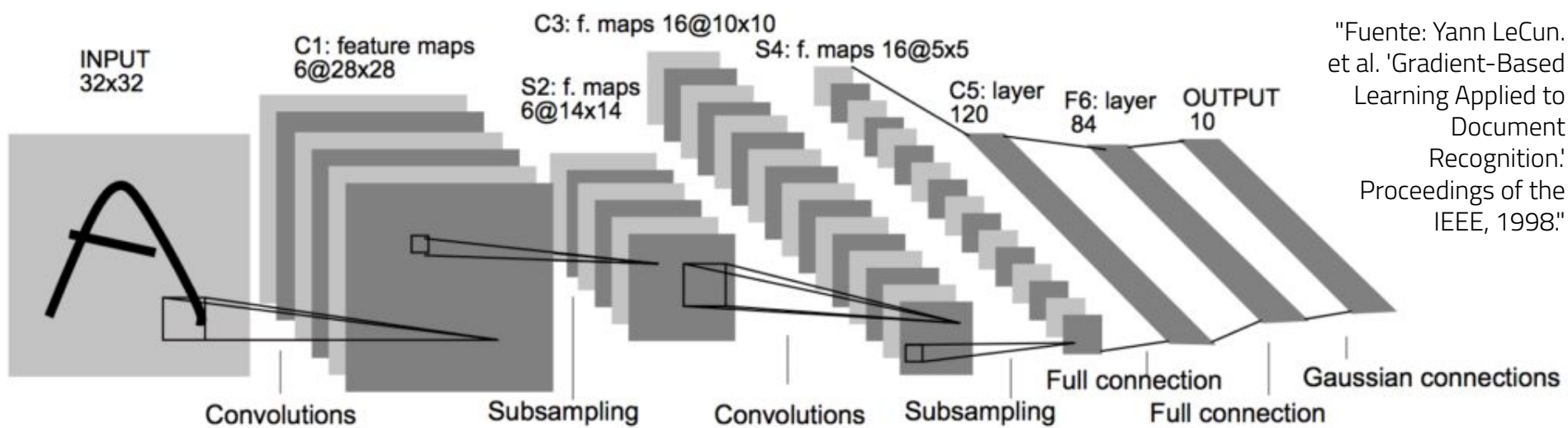
256 input units



3. ARQUITECTURA

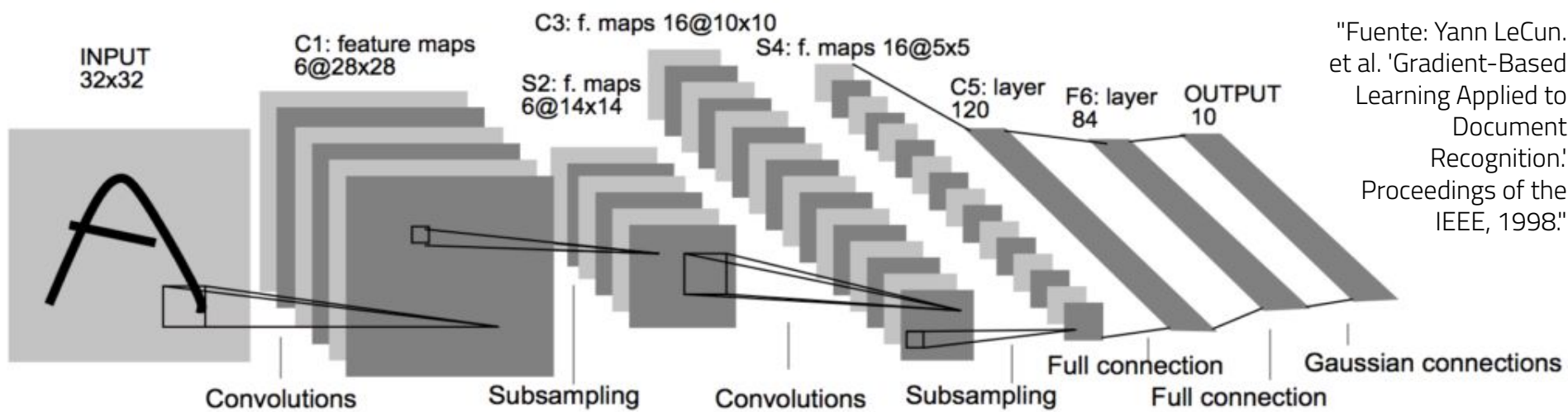
LeNet-5





Contiene:

- Capa de entrada
- Capa convolucional (C1)
- Capa de pooling (S2)
- Capa convolucional (C3)
- Capa de pooling (S4)
- Capa completamente conectada (C5)
- Capa completamente conectada (F6)
- Capa de salida



Capa de entrada

- Imágenes en escala de grises de 32x32 píxeles.

Capa convolucional (C1)

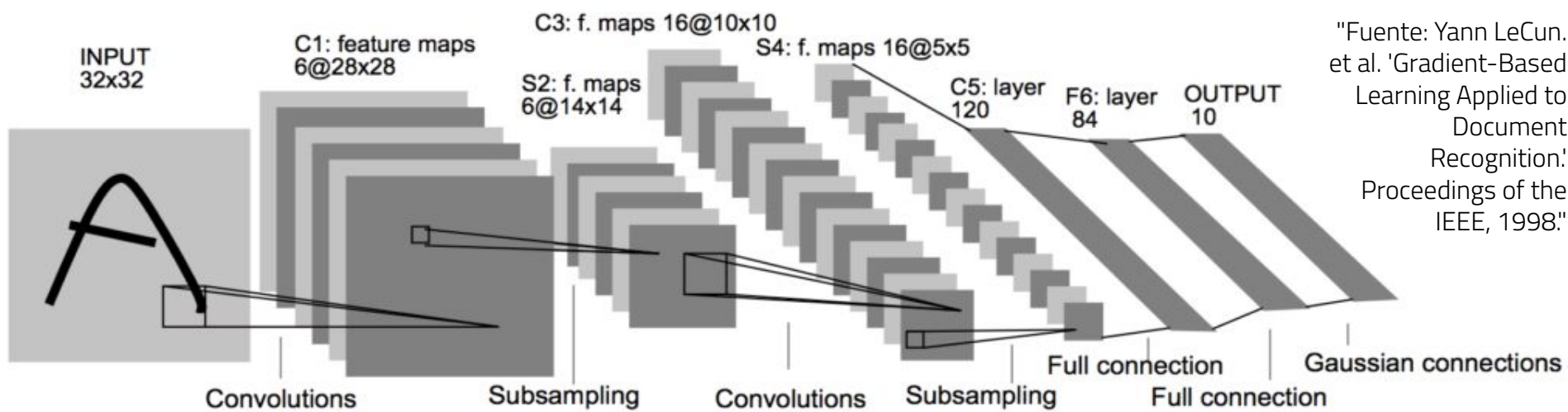
- 6 filtros de tamaño 5x5
- Tangente hiperbólica (tanh)

- Stride: 1
- 6 mapas de características de 28x28

Capa de pooling (S2)

- Average pooling.
- Tamaño de ventana 2x2
- Stride: 2
- 6 mapas de características de 14x14





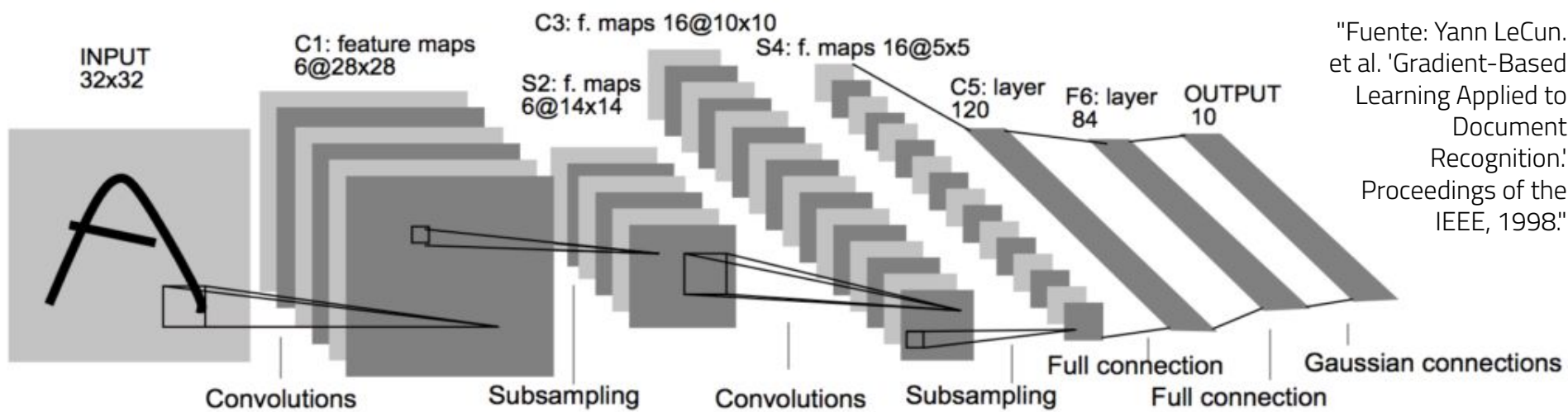
Capa convolucional (C3)

- 16 filtros de tamaño 5x5
- Tangente hiperbólica (tanh)
- Stride: 1
- 16 mapas de características de 10x10

Capa de pooling (S4)

- Average pooling.
- Tamaño de ventana 2x2
- Stride: 2
- 16 mapas de características de 5x5.





Capa completamente conectada (C5)

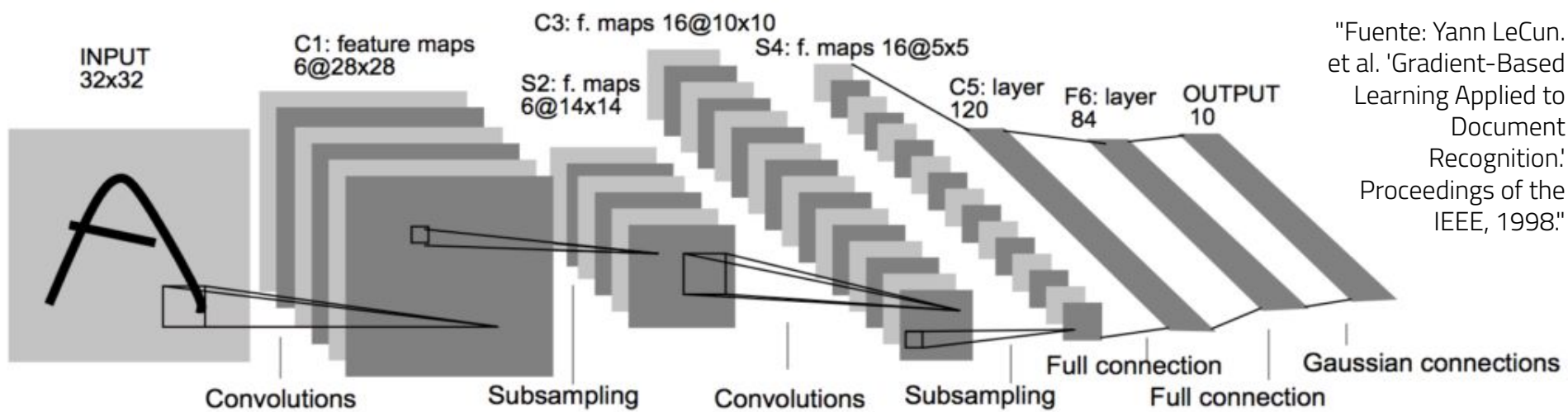
- 120 neuronas totalmente conectadas.
- Tangente hiperbólica (tanh).
- Un vector de 120 dimensiones.

Capa completamente conectada (F6)

- 84 neuronas totalmente conectadas.
- Tangente hiperbólica (tanh).
- Un vector de 84 dimensiones.



"Fuente: Yann LeCun.
et al. 'Gradient-Based
Learning Applied to
Document
Recognition'.
Proceedings of the
IEEE, 1998."



Capa de salida

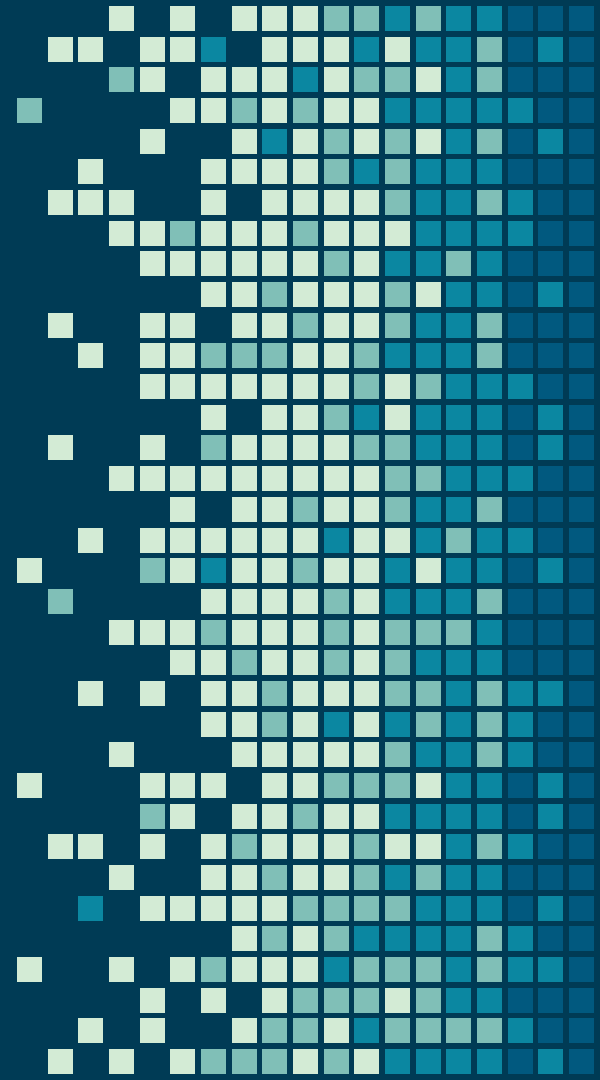
- 10 neuronas (una para cada clase en el conjunto de datos utilizado en el paper).
- Función de activación: Softmax.
- Un vector de probabilidades de 10 dimensiones, representando la probabilidad de cada clase.

- **Gaussian Connections:** Se refiere a la capa de normalización o suavizado, o a la función de activación gaussiana en la capa de salida softmax

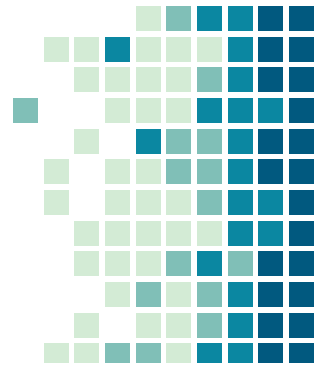
4.

DATASET

MNIST



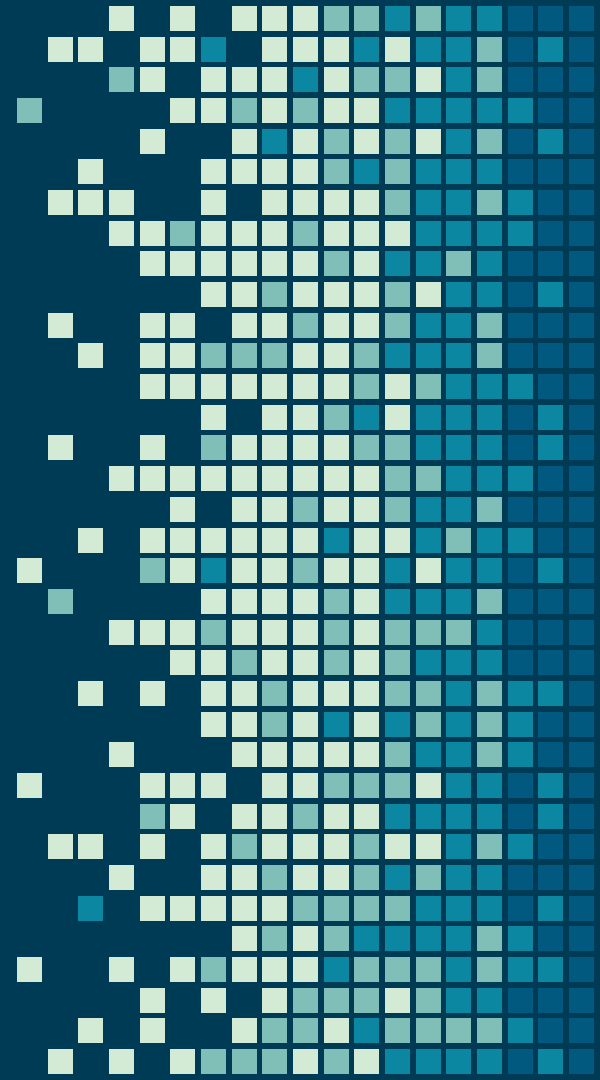
MNIST (Modified National Institute of Standards and Technology database)



- Consiste en imágenes de dígitos escritos a mano, en escala de grises de 28x28 píxeles, donde cada imagen representa un dígito del 0 al 9.
- Conjunto de entrenamiento: 60,000.
- Conjunto de prueba: 10,000.



5. APLICACIÓN



APLICACIONES

Reconocimiento de dígitos y caracteres

Reconocimiento de matrículas de vehículos, reconocimiento de códigos de barras, etc.

Reconocimiento de objetos

Se utiliza para tareas de clasificación de objetos, detección de objetos y segmentación

Reconocimiento facial

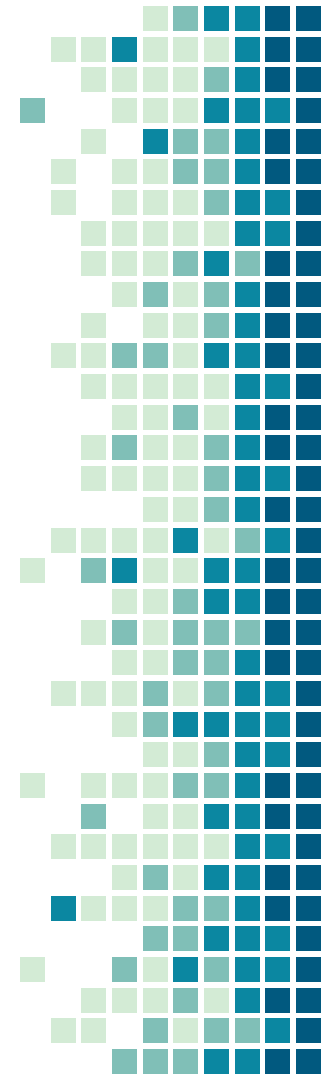
Detectar y reconocer caras en imágenes o videos

Visión por computadora en general

Detección de anomalías, reconocimiento de gestos, seguimiento de objetos, reconstrucción 3D a partir de imágenes, entre otros.

Análisis de imágenes médicas

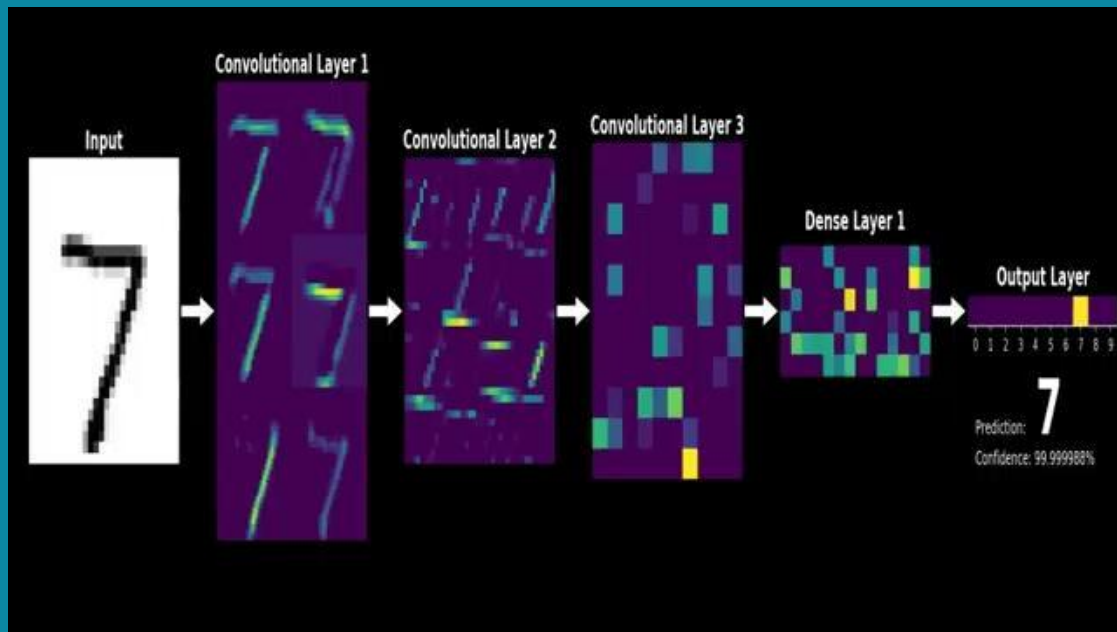
Detectar cáncer de mama, la retinopatía diabética, la detección de tumores cerebrales, entre otros



6. Demo



“ DEMO





CONCLUSIONES

- LeNet fue una de las primeras arquitecturas exitosas de redes neuronales convolucionales, diseñada específicamente para el reconocimiento de caracteres escritos a mano.
-
- La estructura jerárquica de LeNet, permitió extraer características relevantes de las imágenes de entrada y lograr un alto rendimiento en la clasificación de dígitos..





CONCLUSIONES

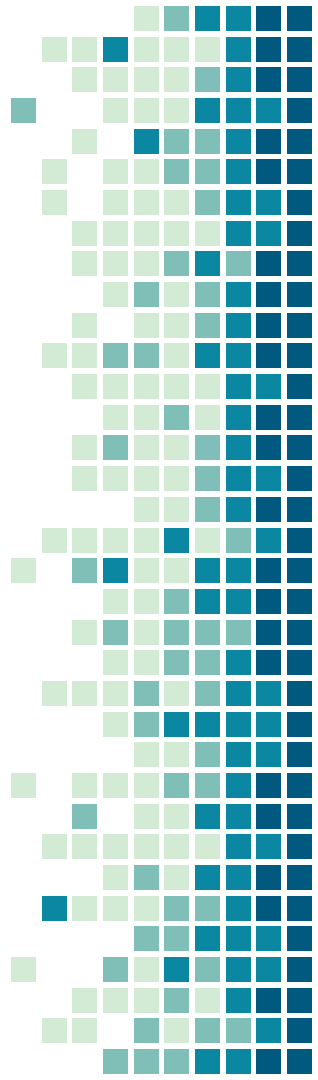
- El entrenamiento y evaluación de LeNet se realizó utilizando el dataset MNIST, demostrando su eficacia en la clasificación de imágenes de dígitos escritos a mano.
-
- LeNet sentó las bases para el desarrollo y avance de otras arquitecturas más sofisticadas de redes neuronales convolucionales, y ha sido ampliamente utilizada en aplicaciones de reconocimiento de patrones y visión por computadora.

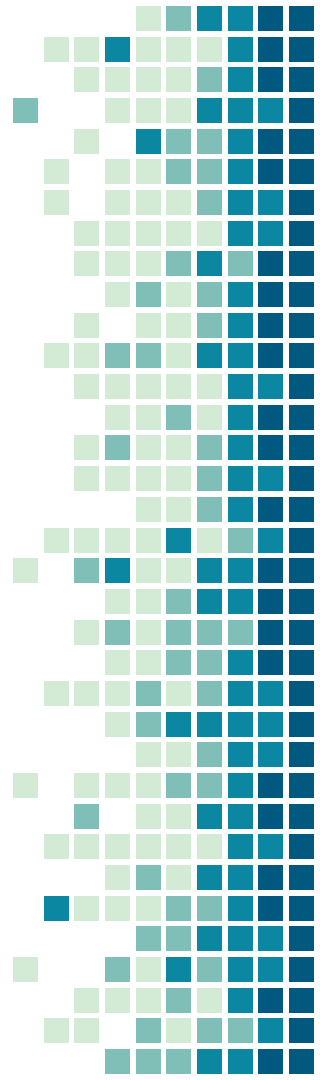
THANKS!

Any questions?

BIBLIOGRAFÍA

"Fuente: Yann LeCun. et al. 'Gradient-Based Learning Applied to Document Recognition.' Proceedings of the IEEE, 1998."

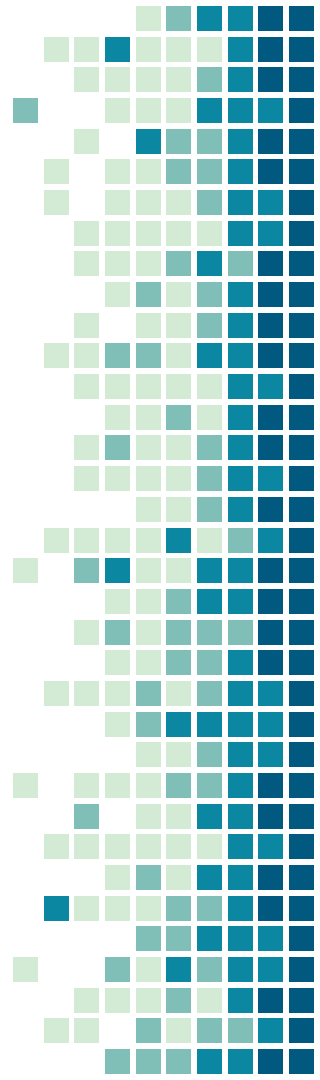




THIS IS A SLIDE TITLE

- Here you have a list of items
- And some text
- But remember not to overload your slides with content

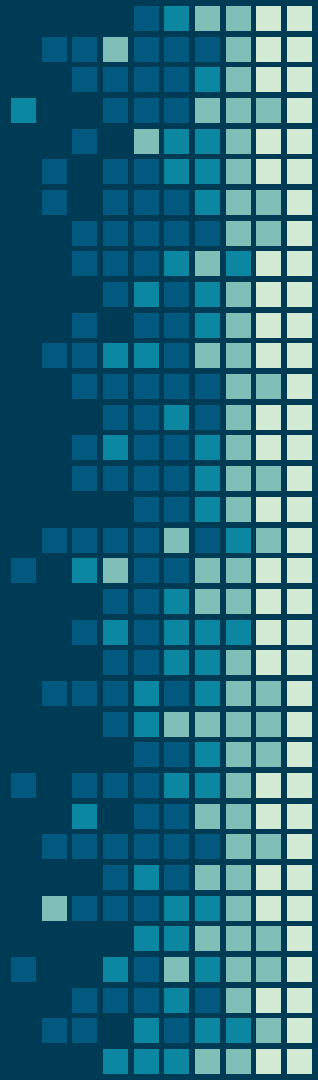
Your audience will listen to you or read the content, but won't do both.





BIG PT

Bring the attention of your audience over
a key concept using icons or illustrations



IN TWO OR THREE COLUMNS

Yellow

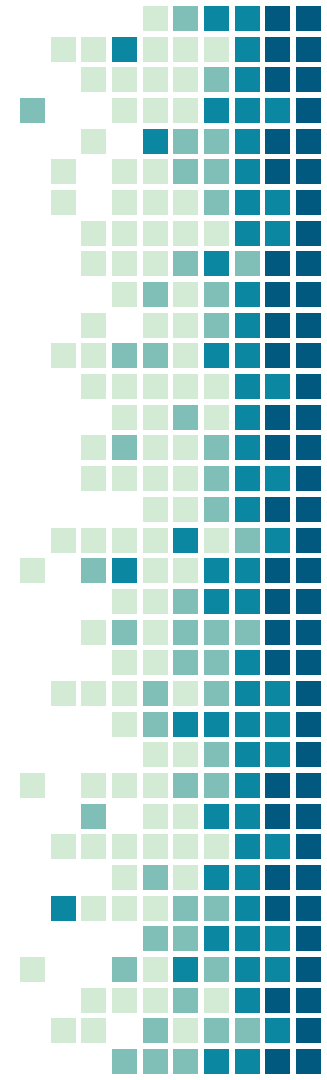
Is the color of gold, butter and ripe lemons. In the spectrum of visible light, yellow is found between green and orange.

Blue

Is the colour of the clear sky and the deep sea. It is located between violet and green on the optical spectrum.

Red

Is the color of blood, and because of this it has historically been associated with sacrifice, danger and courage.



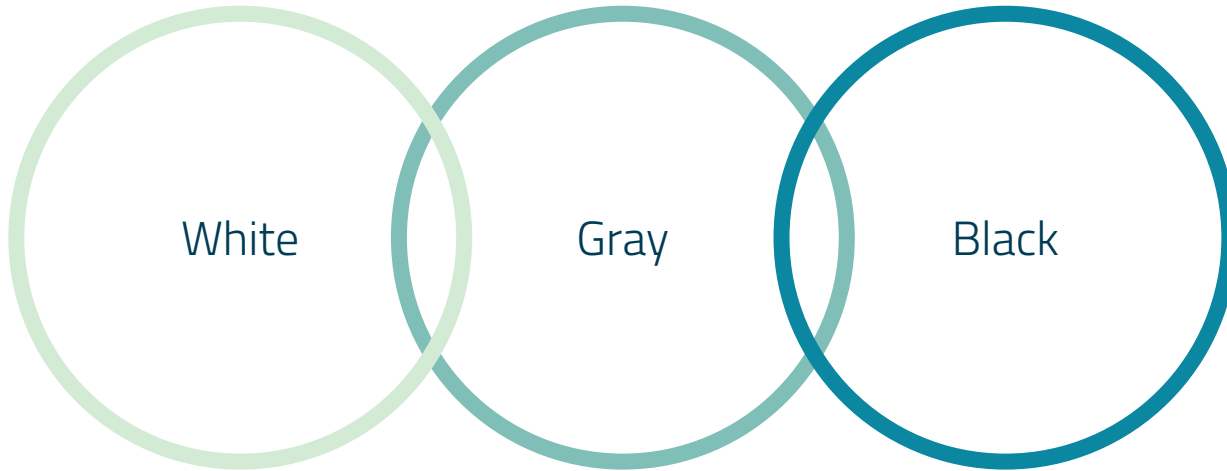


Want big impact?
Use big image.

MAPS



USE CHARTS TO EXPLAIN YOUR IDEAS



AND TABLES TO COMPARE DATA

	A	B	C
Yellow	10	20	7
Blue	30	15	10
Orange	5	24	16

89,526,124

Whoa! That's a big number, aren't you proud?



89,526,124\$

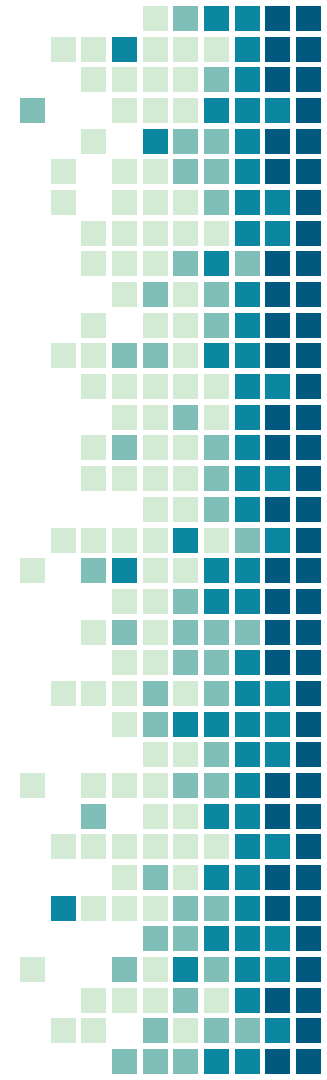
That's a lot of money

185,244 users

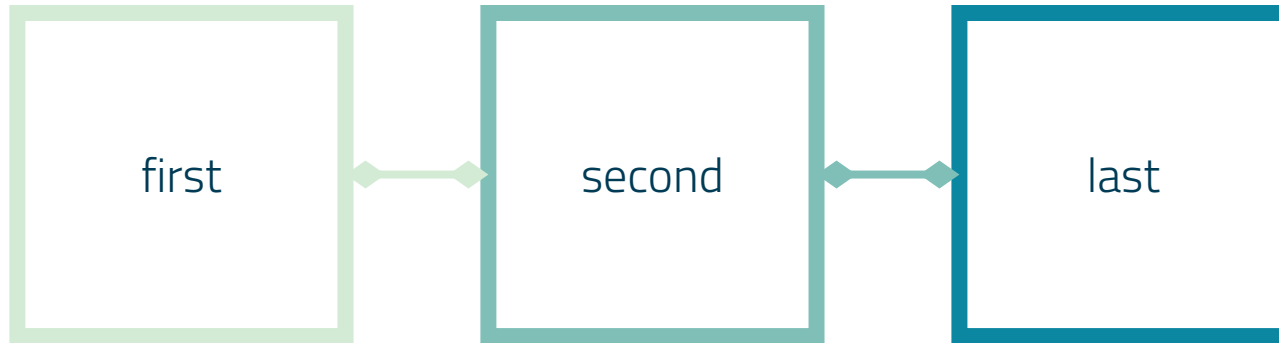
And a lot of users

100%

Total success!



OUR PROCESS IS EASY



LET'S REVIEW SOME CONCEPTS

Yellow

Is the color of gold, butter and ripe lemons. In the spectrum of visible light, yellow is found between green and orange.

Yellow

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Blue

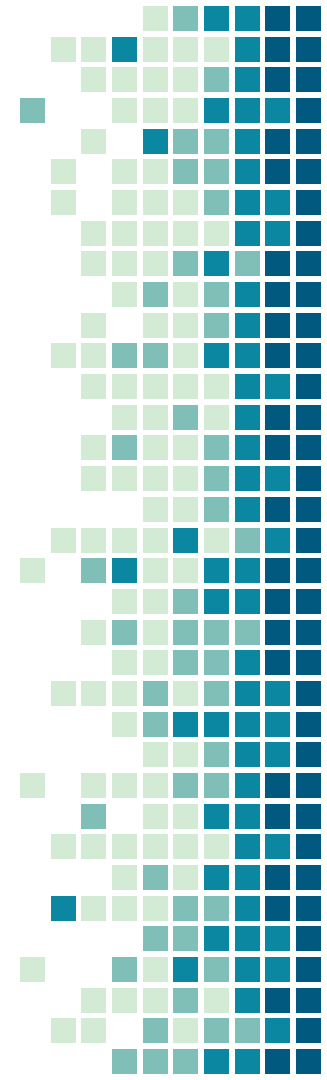
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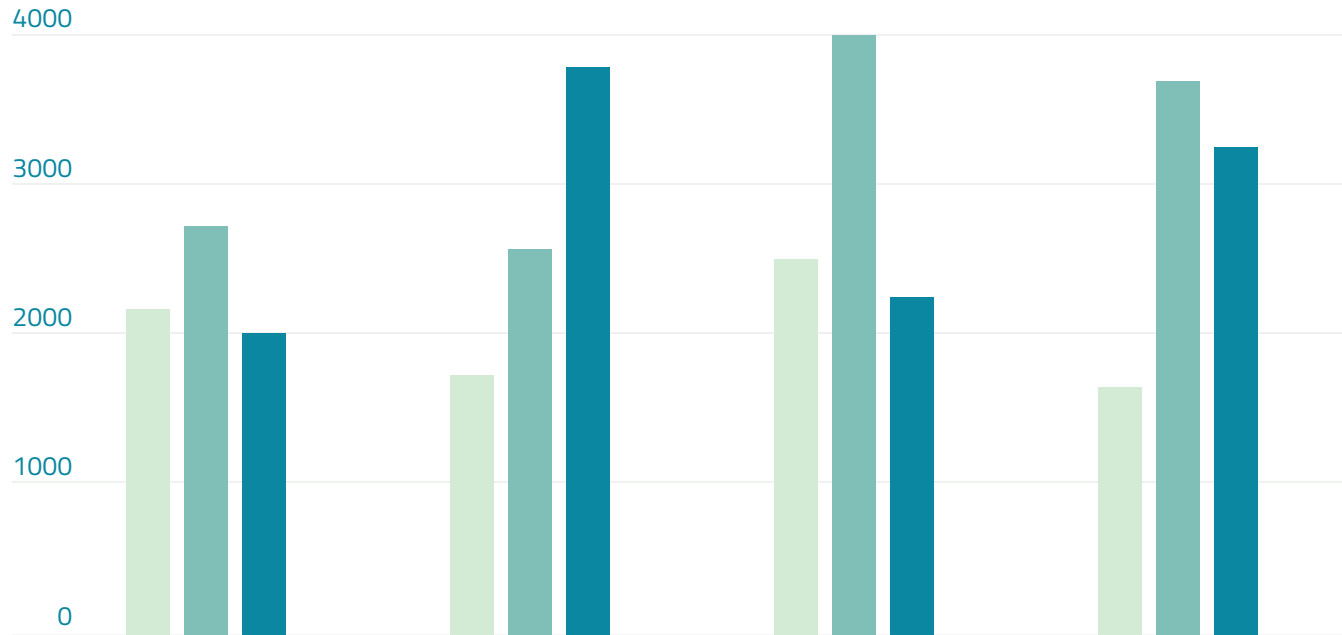
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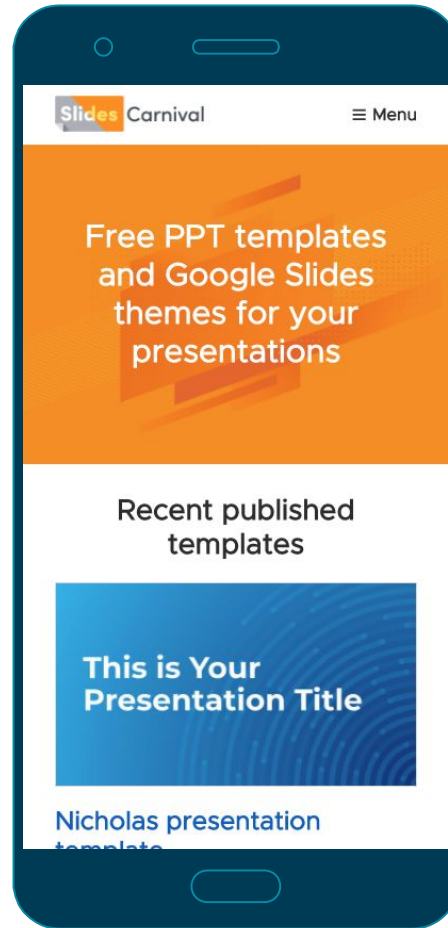




You can insert graphs from Excel or Google Sheets

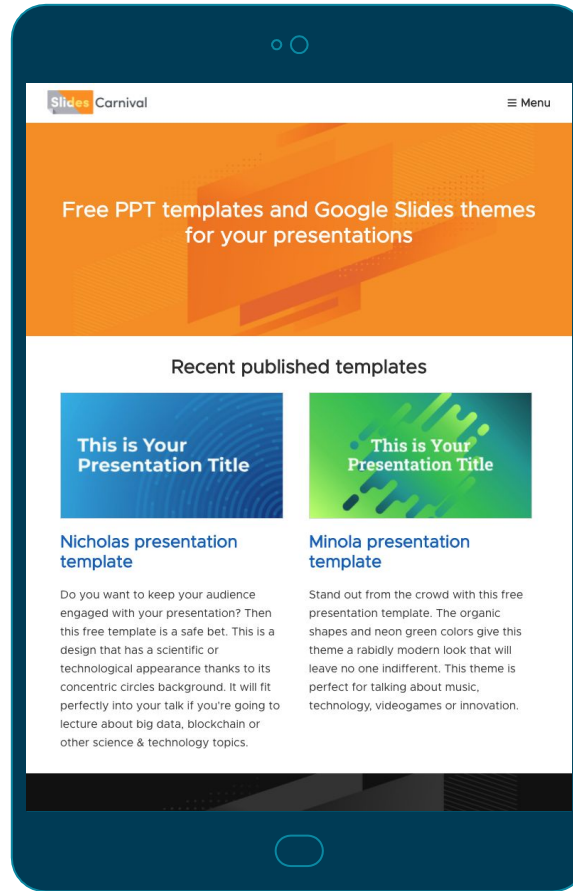
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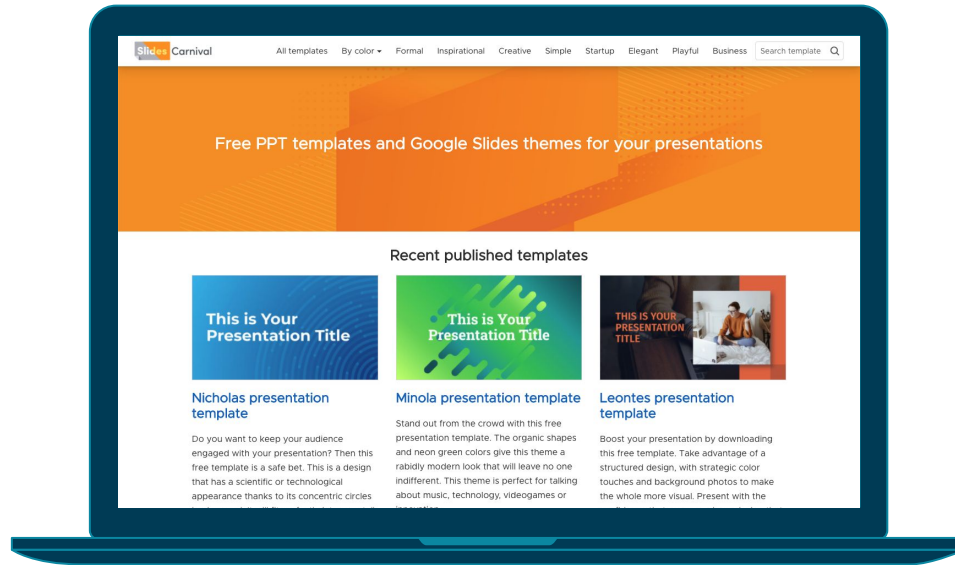
TABLET PROJECT

Show and explain your web, app or software projects using these gadget templates.



DESKTOP PROJECT

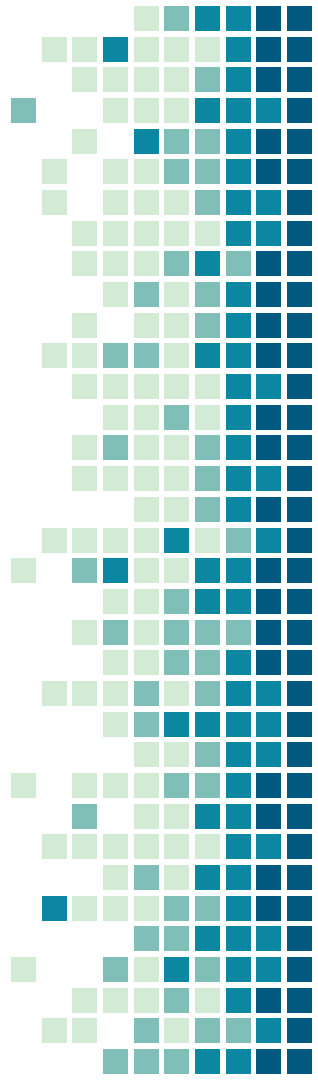
Show and explain your web, app or software projects using these gadget templates.



CREDITS

Special thanks to all the people who made and released these awesome resources for free:

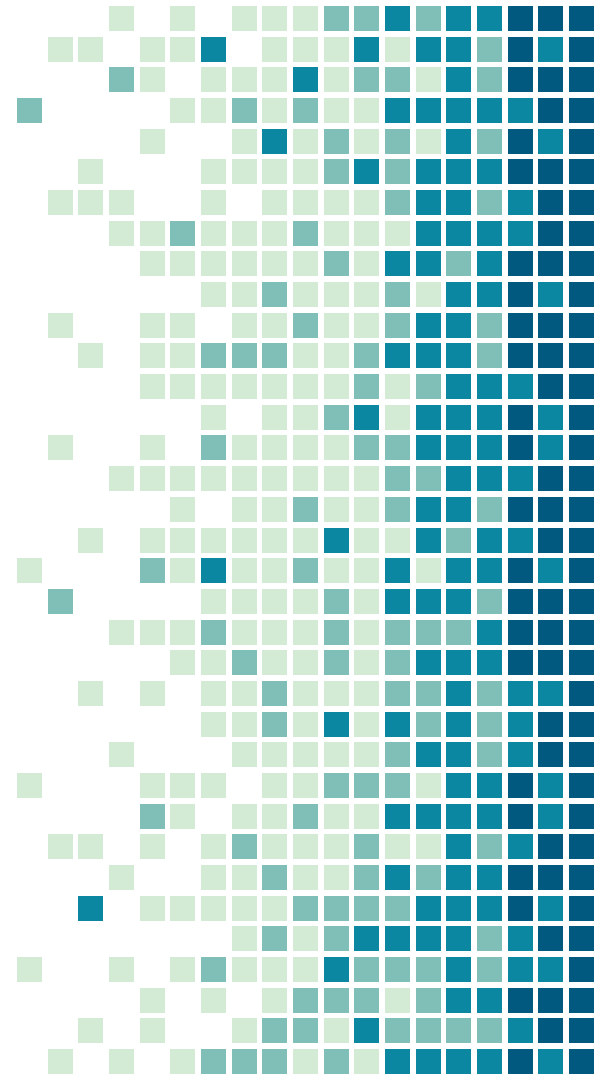
- Presentation template by [SlidesCarnival](#)
- Photographs by [Unsplash](#)



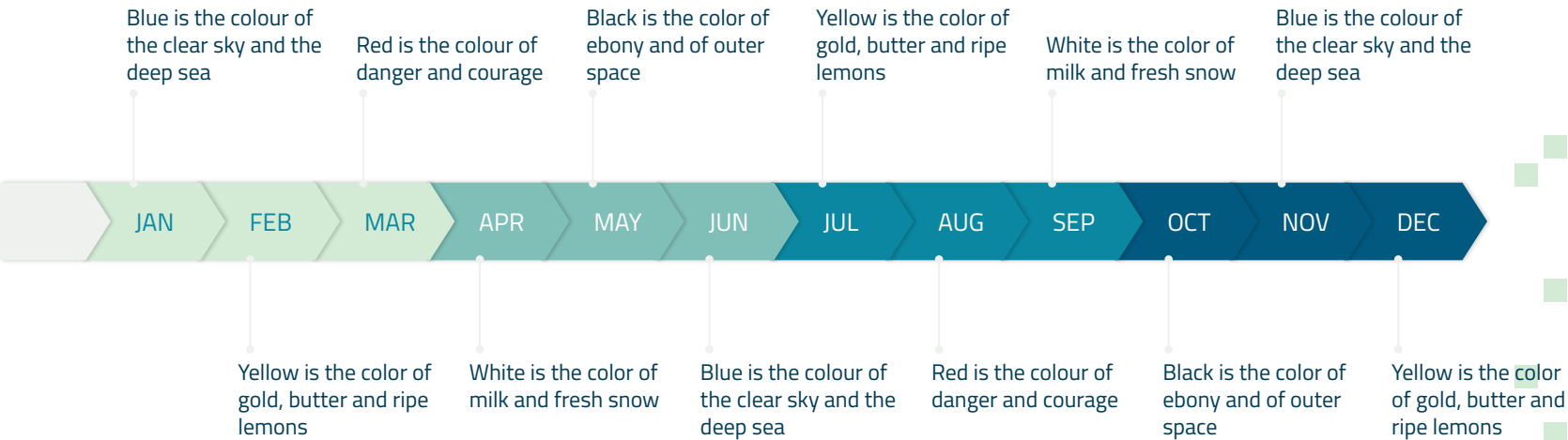
2.

EXTRA RESOURCES

For Business Plans, Marketing Plans,
Project Proposals, Lessons, etc



TIMELINE



ROADMAP

Blue is the colour of the
clear sky and the deep sea

1

Red is the colour of danger
and courage

3

Black is the color of ebony
and of outer space

5

Yellow is the color of gold,
butter and ripe lemons

2

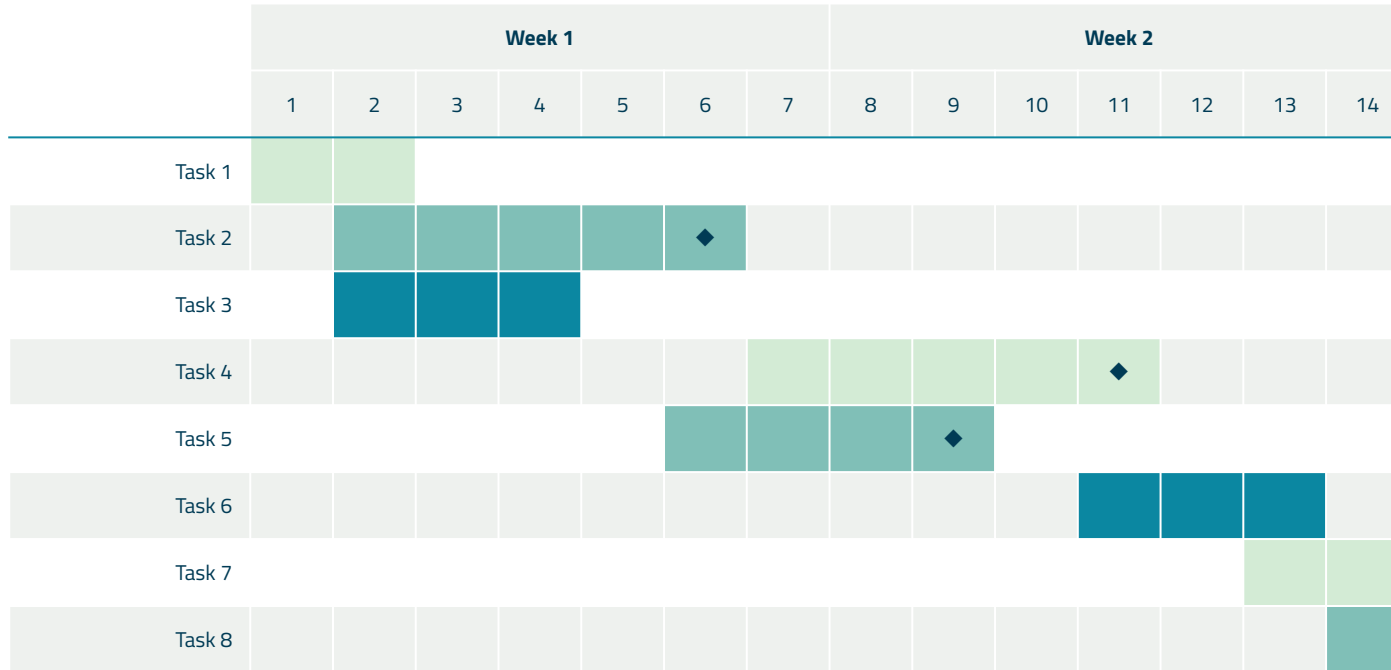
White is the color of milk
and fresh snow

4

Blue is the colour of the
clear sky and the deep sea

6

GANTT CHART



SWOT ANALYSIS

STRENGTHS

Blue is the colour of the clear sky and the deep sea

S

WEAKNESSES

Yellow is the color of gold, butter and ripe lemons

W

Black is the color of ebony and of outer space










OPPORTUNITIES

O

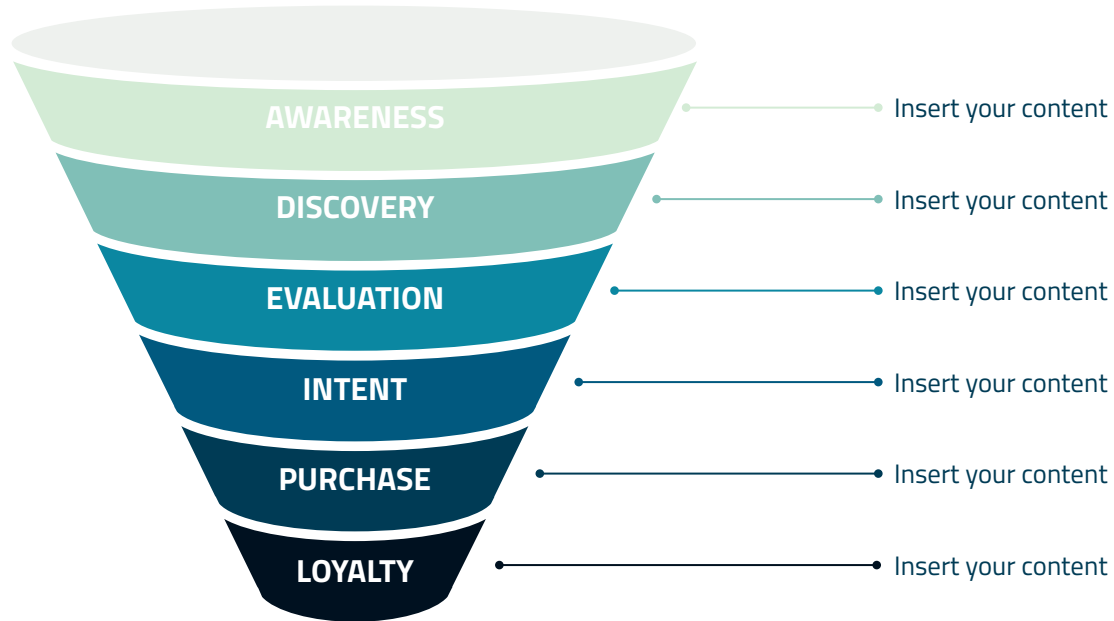
White is the color of milk and fresh snow

THREATS

T

Key Partners Insert your content 	Key Activities Insert your content 	Value Propositions Insert your content 	Customer Relationships Insert your content 	Customer Segments Insert your content 
	Key Resources Insert your content 		Channels Insert your content 	
Cost Structure Insert your content 			Revenue Streams Insert your content 	

FUNNEL



TEAM PRESENTATION



Imani Jackson

JOB TITLE

Blue is the colour of the clear
sky and the deep sea



Marcos Galán

JOB TITLE

Blue is the colour of the clear
sky and the deep sea



Ixchel Valdía

JOB TITLE

Blue is the colour of the clear
sky and the deep sea



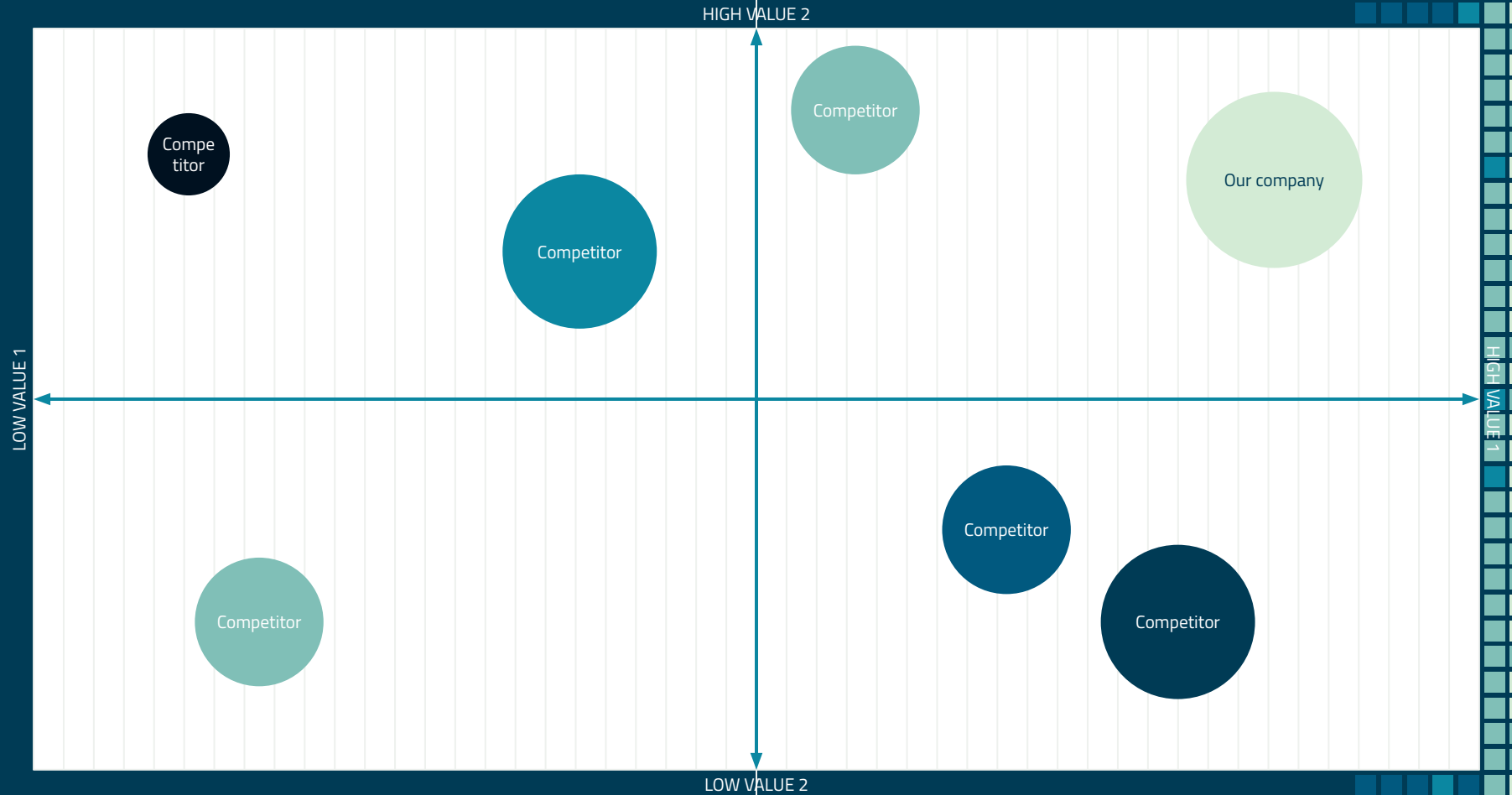
Nils Årud

JOB TITLE

Blue is the colour of the clear
sky and the deep sea

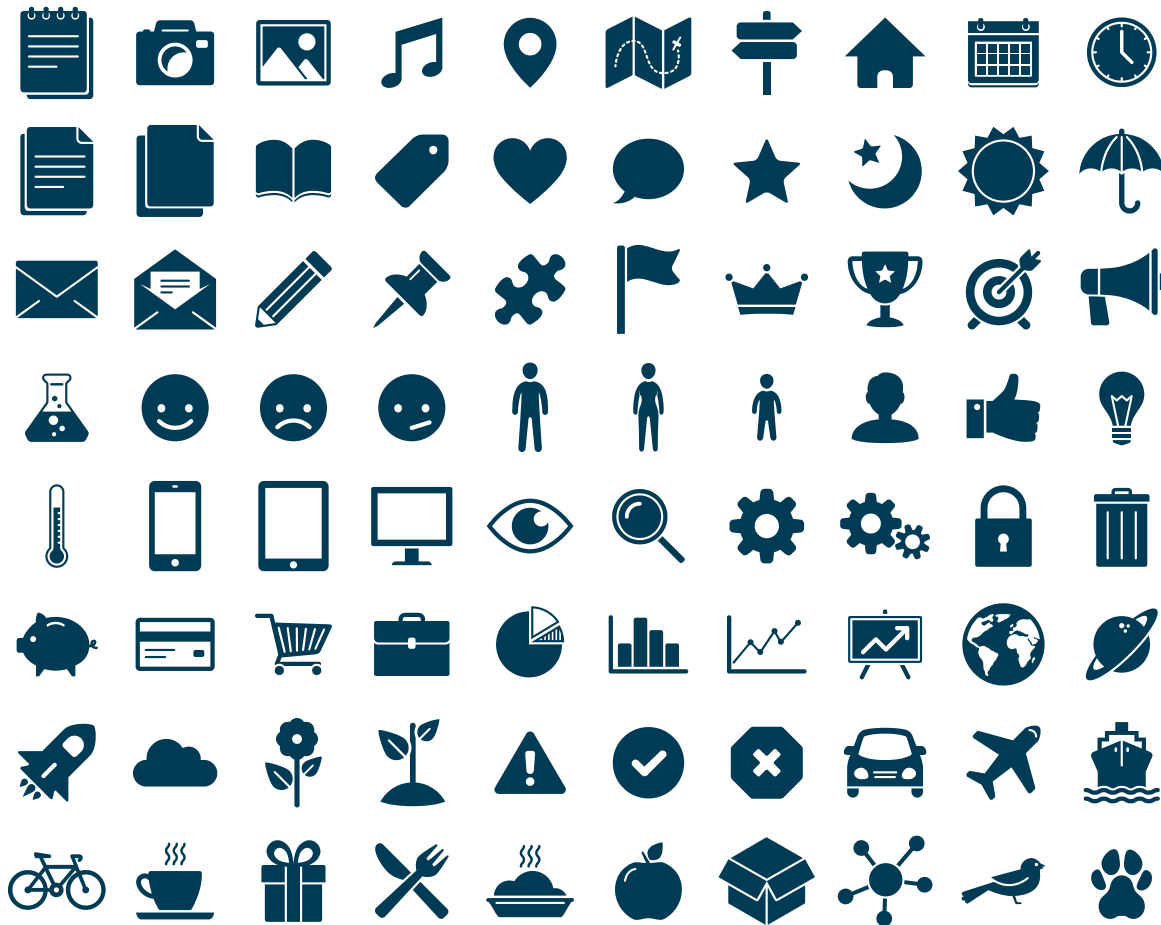


COMPETITOR MATRIX



WEEKLY PLANNER

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
9:00 - 9:45	Task	Task	Task	Task	Task	Task	Task
10:00 - 10:45	Task	Task	Task	Task	Task	Task	Task
11:00 - 11:45	Task	Task	Task	Task	Task	Task	Task
12:00 - 13:15	✓ Free time	✓ Free time	✓ Free time	✓ Free time	✓ Free time	✓ Free time	✓ Free time
13:30 - 14:15	Task	Task	Task	Task	Task	Task	Task
14:30 - 15:15	Task	Task	Task	Task	Task	Task	Task
15:30 - 16:15	Task	Task	Task	Task	Task	Task	Task



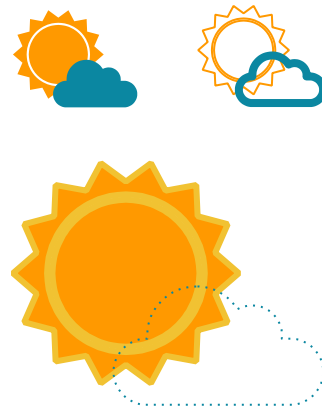
SlidesCarnival icons are editable shapes.

This means that you can:

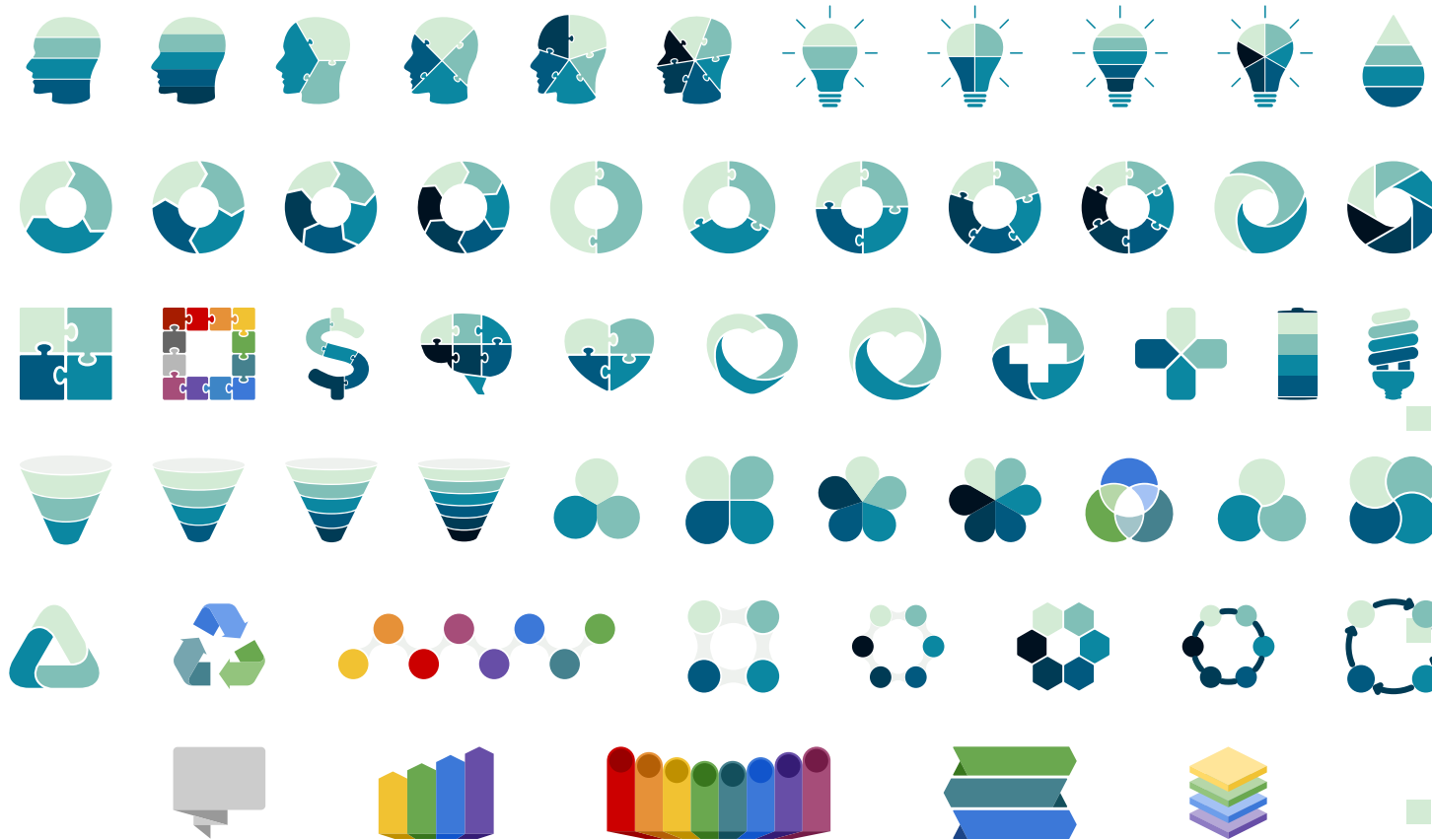
- Resize them without losing quality.
- Change fill color and opacity.
- Change line color, width and style.

Isn't that nice? :)

Examples:



DIAGRAMS AND INFOGRAPHICS



You can also use any emoji as an icon!

And of course it resizes without losing quality.

How? Follow Google instructions

<https://twitter.com/googledocs/status/730087240156643328>



and many more...



Free templates for all your presentation needs



For PowerPoint and
Google Slides



100% free for personal
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Ready to use,
professional and
customizable



Blow your audience
away with attractive
visuals