

A decorative network diagram in the top-left corner, featuring a complex web of interconnected nodes and lines. Some nodes are highlighted with blue circles, and others with blue dots. The lines are thin and gray, creating a mesh-like structure.

# Topic 2

# Generalization

Espen Haugsdal, Vetle Birkeland and Amund Tenstad

A decorative network diagram in the bottom-right corner, similar to the one in the top-left. It shows a network of nodes and lines, with some nodes highlighted by blue circles and others by blue dots.

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- **Regularization**
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  - Dropout
- **Increasing data**

# Generalization

Performing well on  
previously unseen data





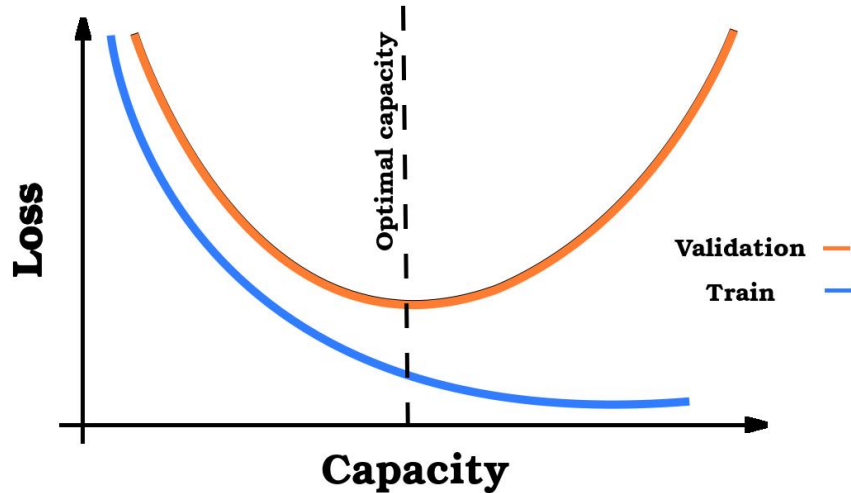
“

*Generalization refers to your model's ability to adapt properly to new, previously **unseen data**, drawn from the same distribution as the one used to create the model.*

# Generalization

“Generalization refers to your model's ability to adapt properly to new, previously **unseen data**, drawn from the same distribution as the one used to create the model.

- Model that performs well on **unseen** examples
- Model that performs similarly on **validation** and training



# Underfitting vs Overfitting

## Underfitting

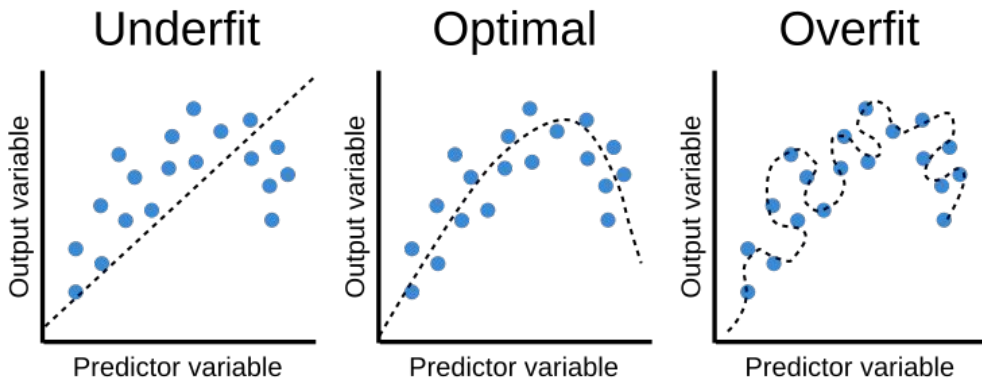
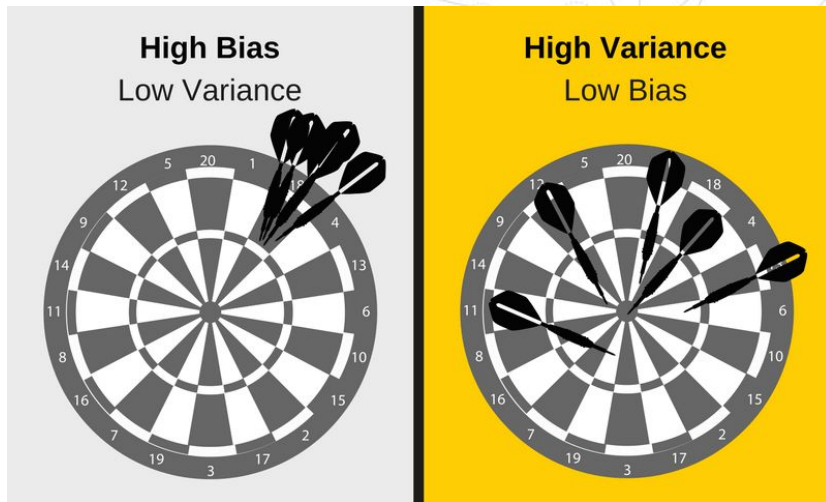
- Does not capture underlying trends

## Overfitting

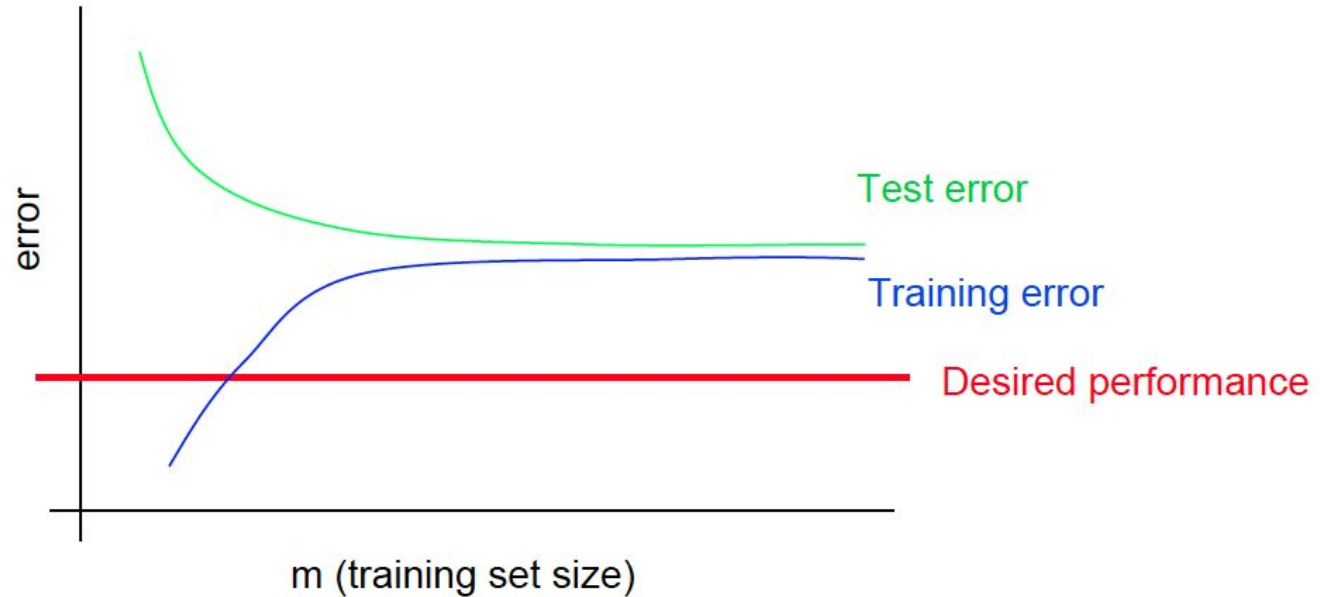
- Too specialized
- Memorization
- Captures regularities which are not part of the underlying trend

## Overfitting Causes

- Small dataset
- Complex model



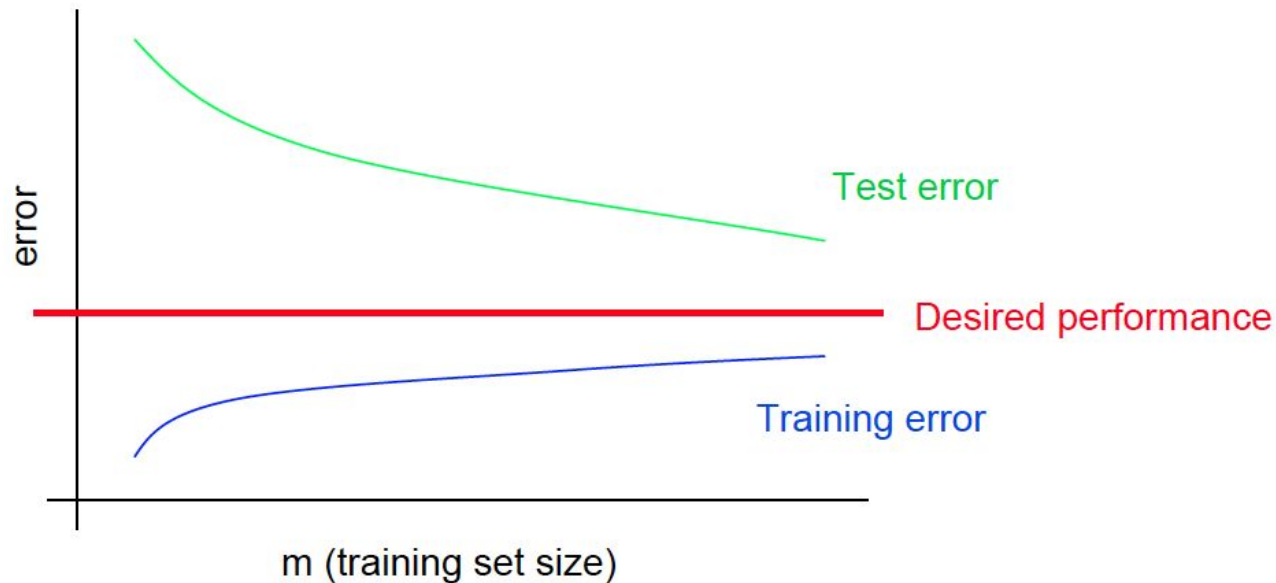
## Typical learning curve for high bias:



- Even training error is unacceptably high.
- Small gap between training and test error.



## Typical learning curve for high variance:

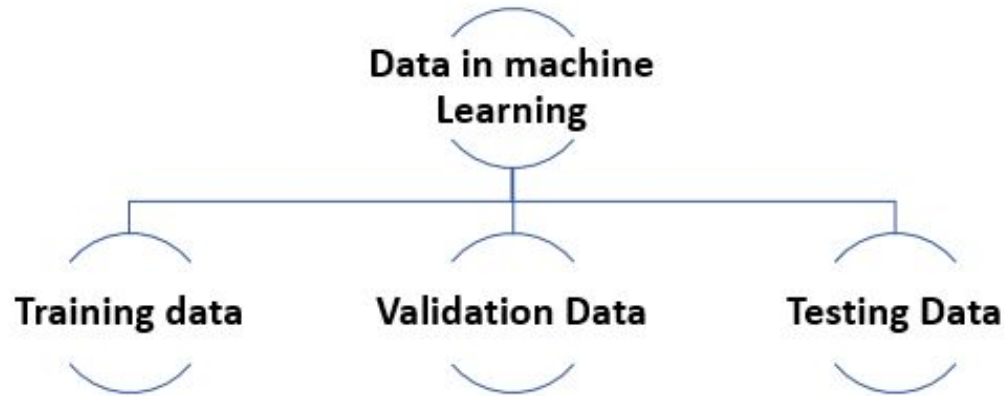


- Test error still decreasing as  $m$  increases. Suggests larger training set will help.
- Large gap between training and test error.





# Splitting data



# Cross validation

## Train

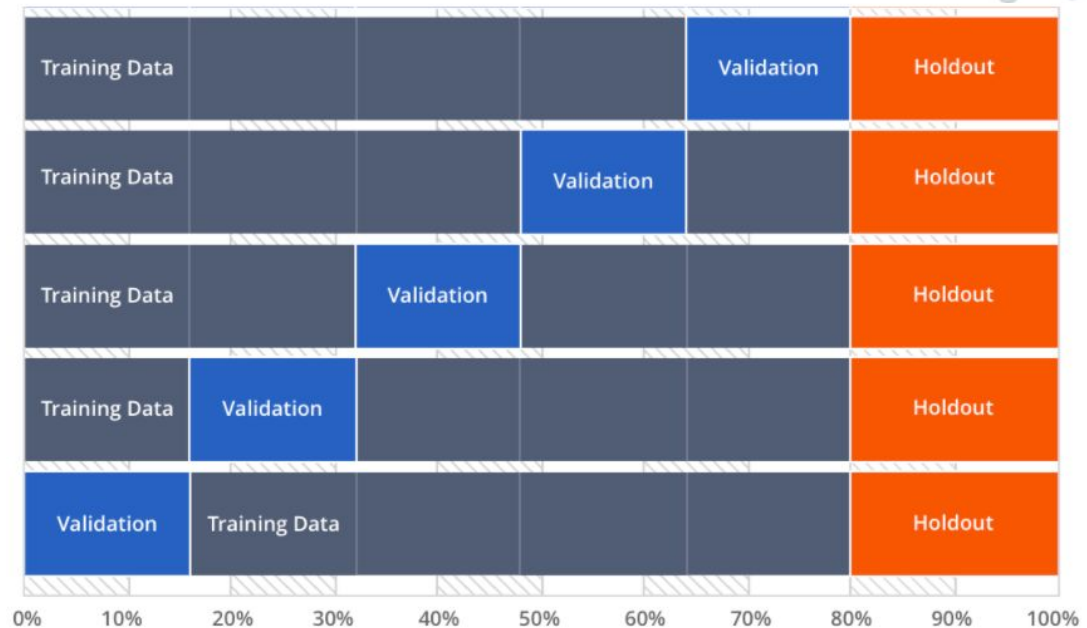
Train the model

## Validation

Evaluate the model  
during training

## Test (Holdout)

Final evaluation





# Regularization

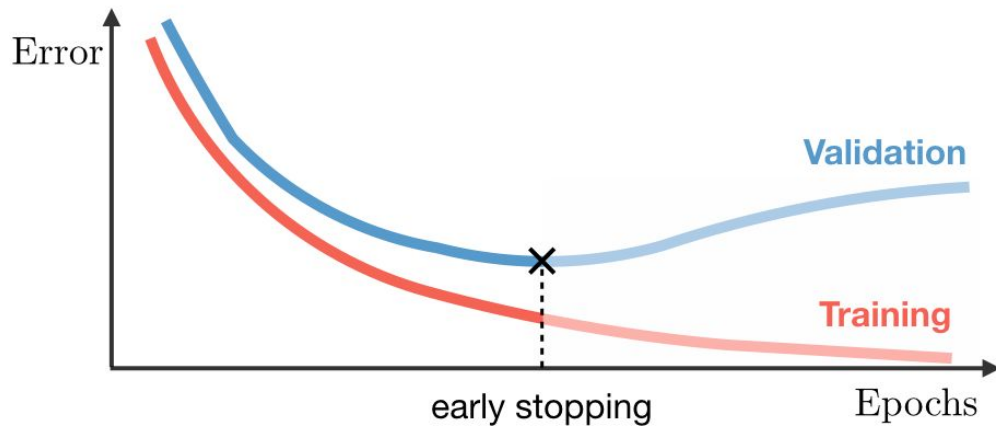
**Techniques to improve the generalizability of a learned model.**



## Early stopping

Stop training when validation loss has been increasing for a few iterations


Save model periodically and use the model with the lowest validation loss





## L1/L2 regularization

- **Add regularization term to cost function**
  - Discourages large weights (complexity)
  - Weight restriction
- **Trade off**
  - Benefit from increase in complexity of weights must outweigh the cost

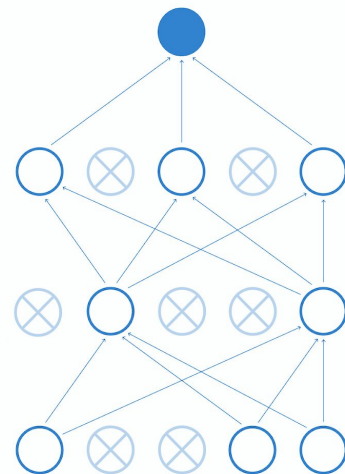
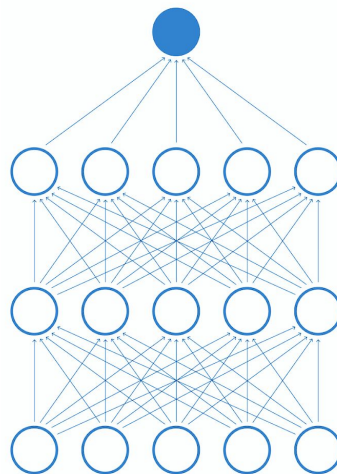

$$C = C_0 + \frac{\lambda}{n} \sum_w |w|$$

$$C = C_0 + \frac{\lambda}{2n} \sum_w w^2$$



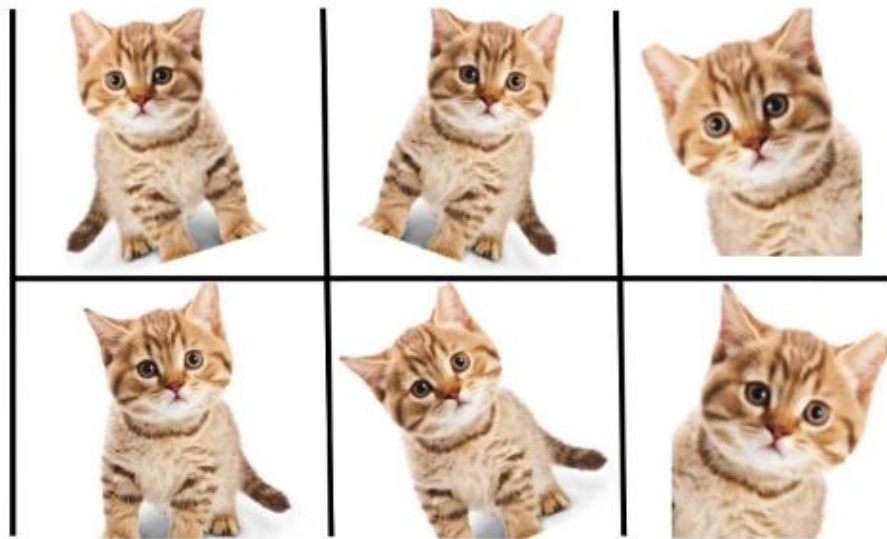
# Dropout

- **Randomly block nodes**
  - Disable inbound and outbound weights
- **Forces exploration of new paths**
  - Many “subnetworks”
  - Combined evaluation



# Can I haz moar data

Pls :3



# Thanks!

## Any questions?





## Credits

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

- ◎ Presentation template by SlidesCarnival
- ◎ Photographs by Unsplash













The background of the slide is a light gray network pattern. It consists of numerous small circles, some of which are solid gray and others are hollow with a gray outline. These circles are interconnected by a web of thin, light gray lines, creating a complex, organic-looking structure that resembles a molecular or biological network.

# STAPH!!!

A decorative graphic in the top-left corner featuring a network of interconnected nodes and lines. Some nodes are highlighted with blue circles or dots.

**This is your  
presentation  
title**

A decorative graphic in the bottom-right corner, similar to the one in the top-left, showing a network of nodes and lines with some blue highlights.



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# Hello!

## I am Jayden Smith

I am here because I love to  
give presentations.

You can find me at:

@username



A decorative network diagram in the top-left corner, featuring a complex web of interconnected nodes and lines, with some nodes highlighted in blue and others in grey.

1.

# Transition headline

Let's start with the first set of slides

A decorative graphic at the top of the slide featuring a network of interconnected nodes and lines. A central node is highlighted with a dashed circle and contains a large blue quotation mark.

“


*Quotations are commonly printed  
as a **means of inspiration** and to  
invoke philosophical thoughts from  
the reader.*



## 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 concept

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



## You can also split your content

### **White**

Is the color of milk and fresh snow, the color produced by the combination of all the colors of the visible spectrum.

### **Black**

Is the color of coal, ebony, and of outer space. It is the darkest color, the result of the absence of or complete absorption of light.

## 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.



## A picture is worth a thousand words

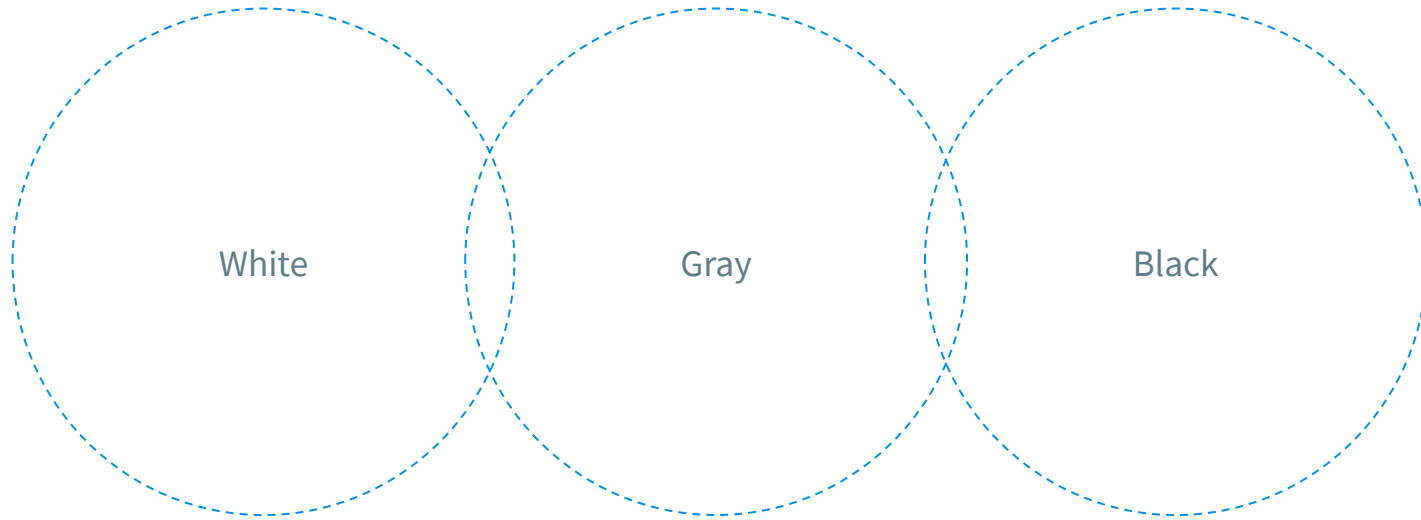
A complex idea can be conveyed with just a single still image, namely making it possible to absorb large amounts of data quickly.



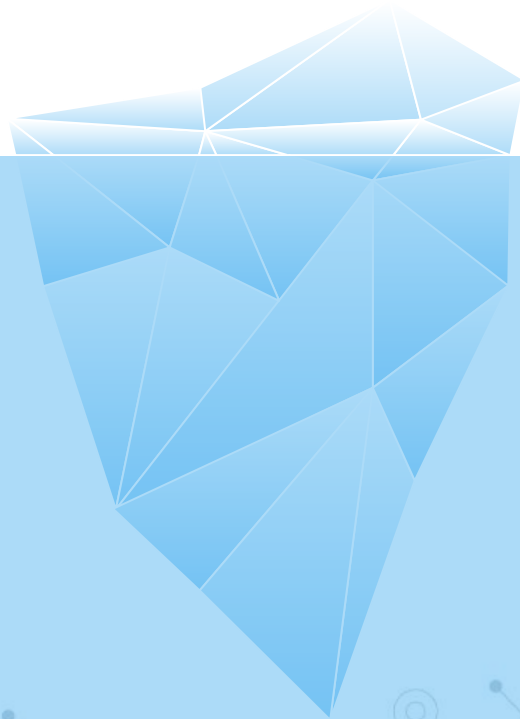


**Want big  
impact?**  
Use big image.

## Use charts to explain your ideas



## Or diagrams to explain complex ideas



### Example text.

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nam venenatis nisi at nisl tempor, et luctus diam lobortis. Nulla sit amet metus consequat velit iaculis tempor.

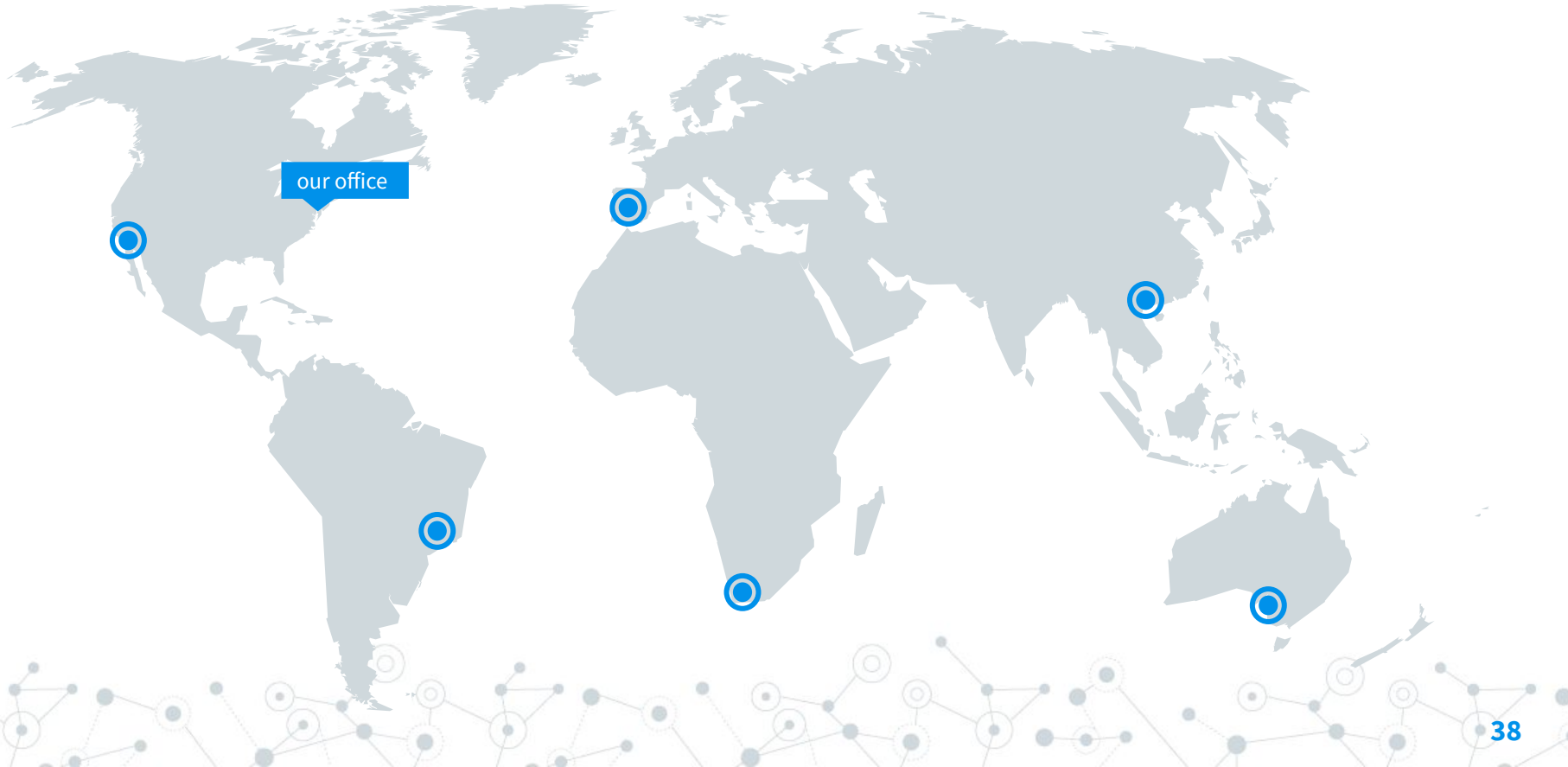
### Example text.

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nam venenatis nisi at nisl tempor, et luctus diam lobortis. Nulla sit amet metus consequat velit iaculis tempor.

## And tables to compare data

	A	B	C
Yellow	<b>10</b>	<b>20</b>	<b>7</b>
Blue	<b>30</b>	<b>15</b>	<b>10</b>
Orange	<b>5</b>	<b>24</b>	<b>16</b>

# Maps



A light gray background featuring a complex network of interconnected nodes and lines, resembling a molecular or data network structure.

# 89,526,124

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

A decorative network diagram in the top-left corner, featuring a complex web of interconnected nodes and lines, with some nodes highlighted in blue.

# 89,526,124\$

That's a lot of money

# 185,244 users

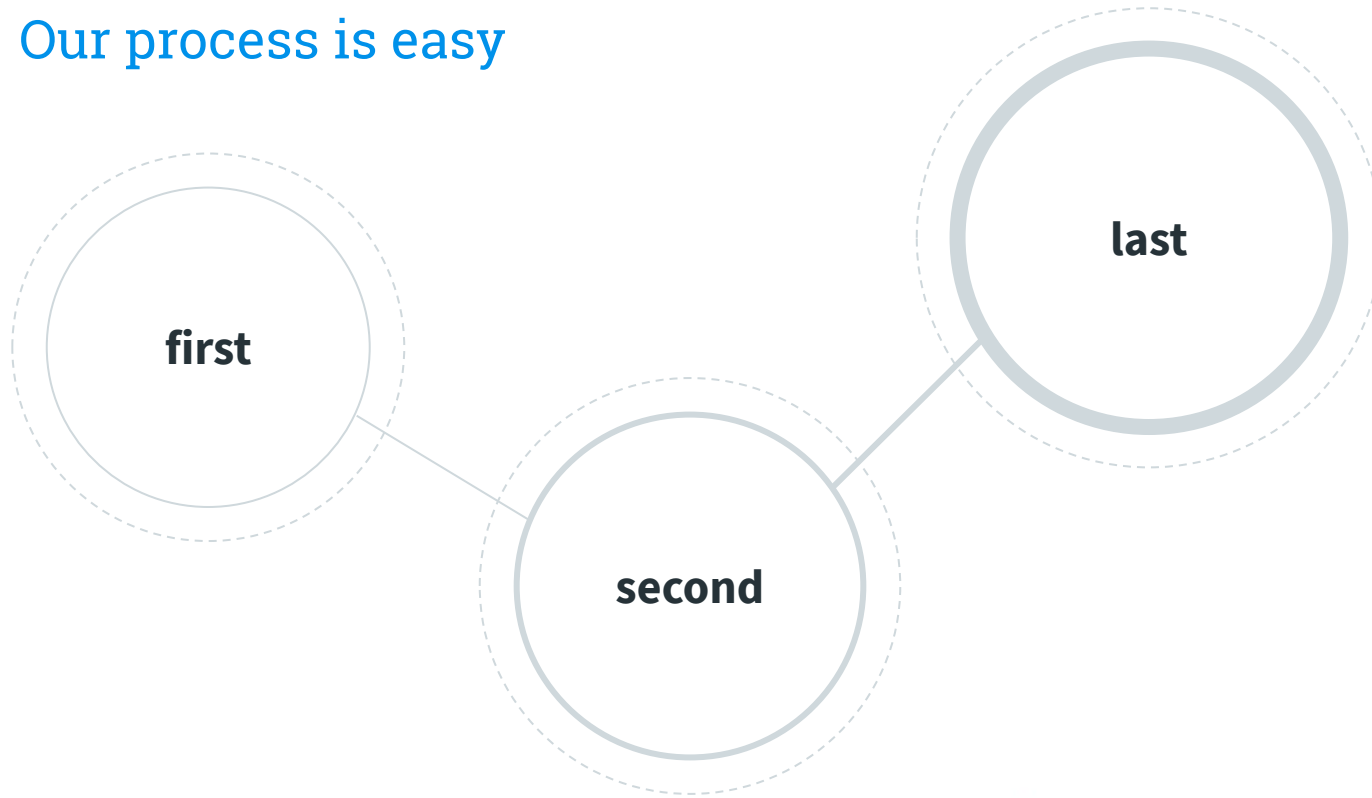
And a lot of users

# 100%

Total success!



Our process is easy



# Let's review some concepts



## Yellow

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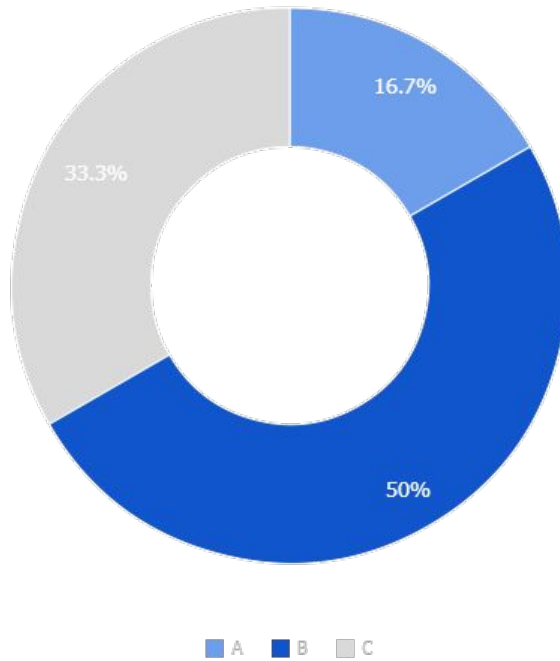
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## Red

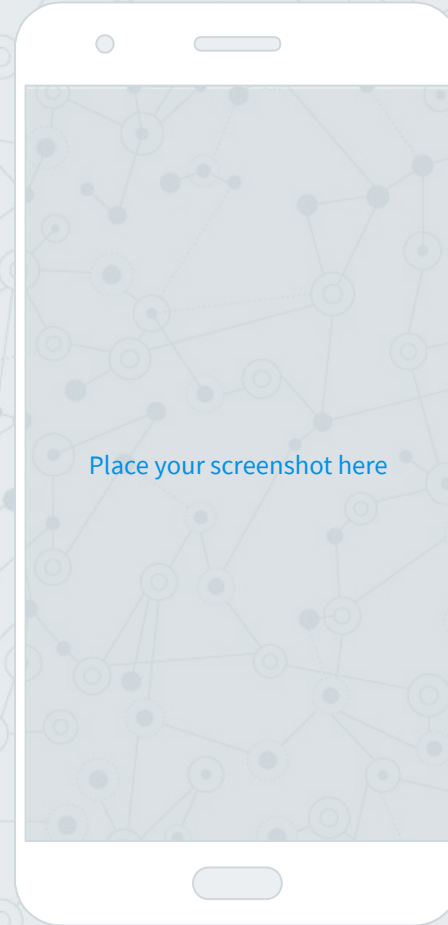
Is the color of blood, and because of this it has historically been associated with sacrifice, danger and courage.



You can copy&paste graphs from Google Sheets

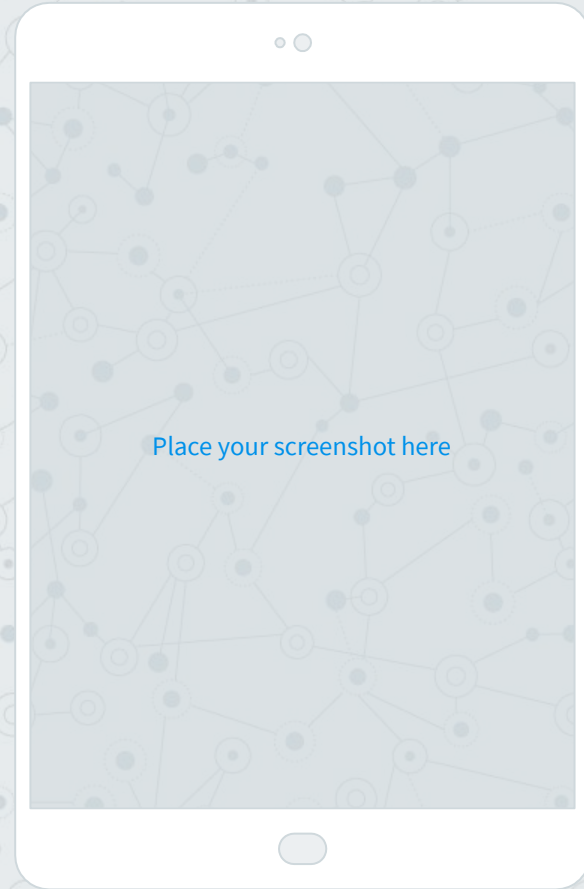
# Mobile project

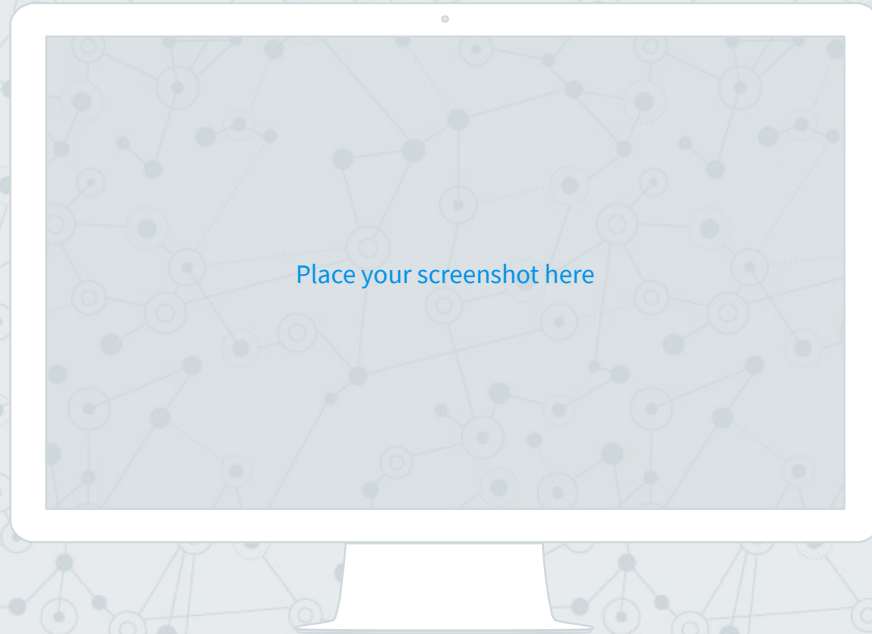
Show and explain your web, app or software projects using these gadget templates.



## 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.



# Thanks!

## Any questions?

You can find me at:

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## Credits

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- ◎ Presentation template by SlidesCarnival
- ◎ Photographs by Unsplash



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- Blue **#0091ea**
- Dark gray **#263238**
- Medium gray **#607d8b**
- Light gray **#cfd8dc**

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This means that you can:

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

Isn't that nice? :)

Examples:



**Now you can use any emoji as an icon!**

And of course it resizes without losing quality and you can change the color.

How? Follow Google instructions

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



and many more...