

Pizza-vision



Ethan Feldman
Metis 2021

**Have you
ever...**

Had a favorite pizzeria close

Moved to a new town and wanted a taste of home

Scrolled endlessly through restaurant options

Just wanted to discover something new

My story



My wife's favorite pizzeria closed

My story



My wife's favorite pizzeria closed
It did not fit neatly into a style

My story



My wife's favorite pizzeria closed
It did not fit neatly into a style
I can still find pictures online

My story



My wife's favorite pizzeria closed
It did not fit neatly into a style
I can still find pictures online

**Can I build a tool to output recommendations
based on those images?**

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Data

Chicagoland Yelp

Images were scraped from restaurant pages

Photos for Lou Malnati's Pizzeria - Search Results



Add photos

< All (5001) Food (3756) Inside (307) Outside (251) Menu (192) Drink (100) >

pizza



632 photos mention "pizza" Clear



Mistagged images were removed from the dataset

Photos for Lou Malnati's Pizzeria - Search Results



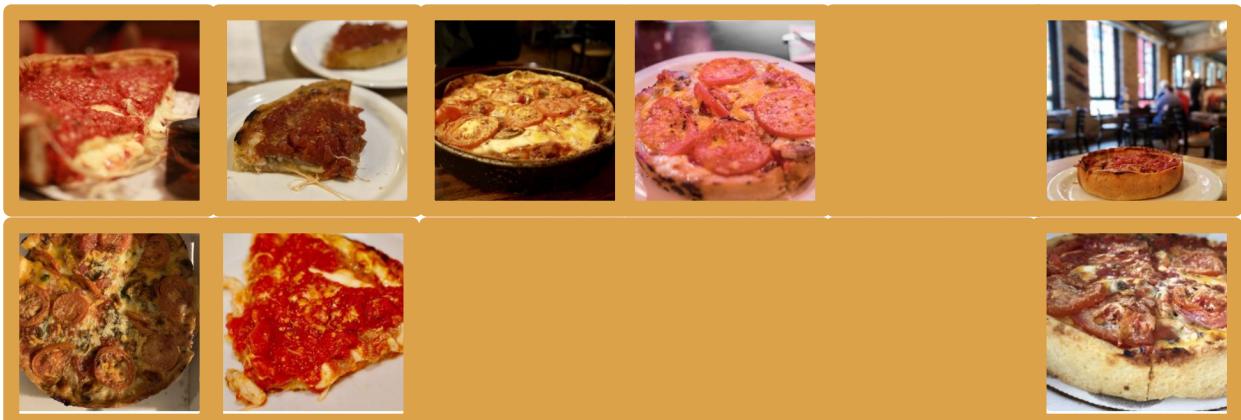
Add photos

< All (5001) Food (3756) Inside (307) Outside (251) Menu (192) Drink (100) >

pizza



632 photos mention "pizza" Clear X



Recommended reviews were scraped from pages



Barby W.

Manhattan, KS

0 52 109



2/16/2021

2 photos 1 check-in

We tried this place on the recommendation of our Uber driver. It didn't disappoint! The appetizer, local beer, and deep dish pizza were all wonderful. We added basil to the crust and it was just amazing. Everyone should stop by.

Reviews were narrowed down to pertinent sentences



Barby W.
Manhattan, KS
 0 52 109

2/16/2021

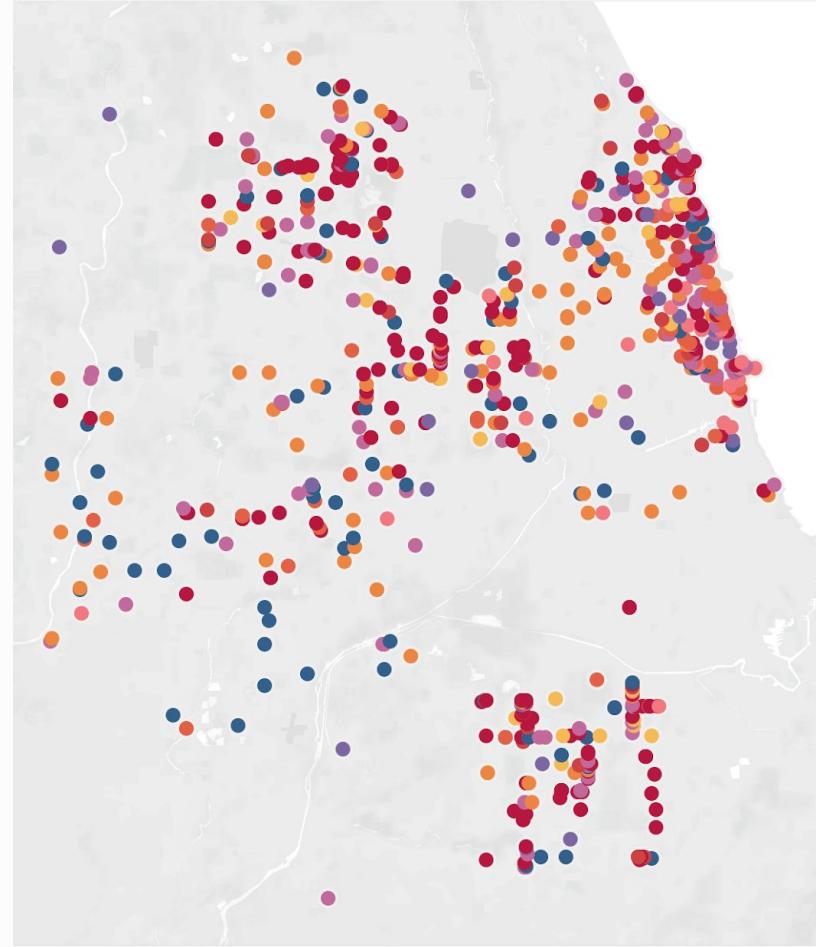
2 photos 1 check-in

The appetizer,
local beer, and deep dish pizza were all wonderful. We added basil to the crust and it was just amazing.

Using images and reviews, I hoped to...

- Create or assign numerical representation of images and of reviews
- Use both representations to find similarity between restaurants to power recommendations

Distribution of restaurants around Chicago, by topic



02

Neural Nets

Image processing

Three image processing Neural Nets were tested



Pretrained Resnet

Extract weights from existing model

Fine-tuned Resnet

Added layers of training on new images before extracting

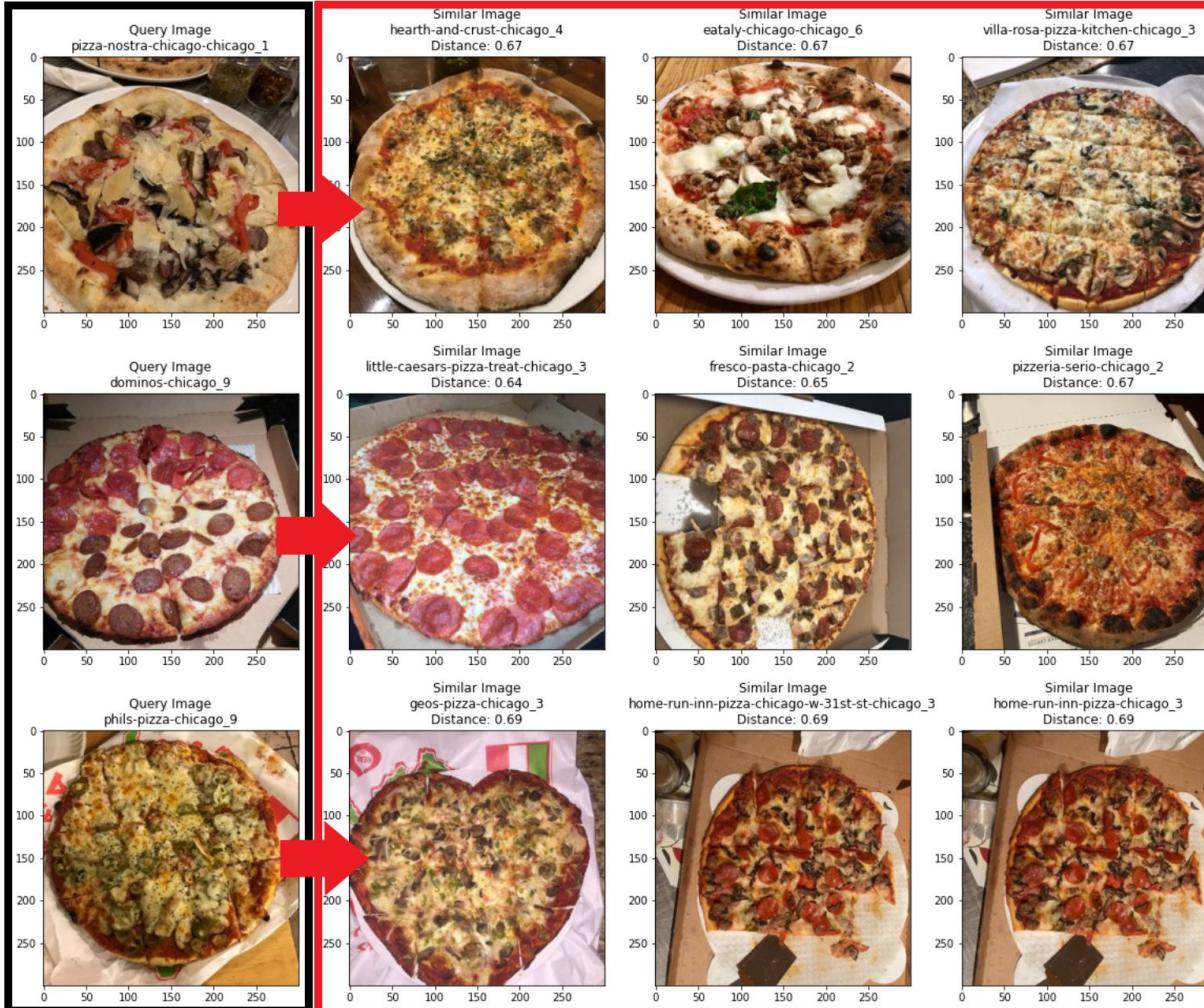
Autoencoder

Extracting embedding from coded layer

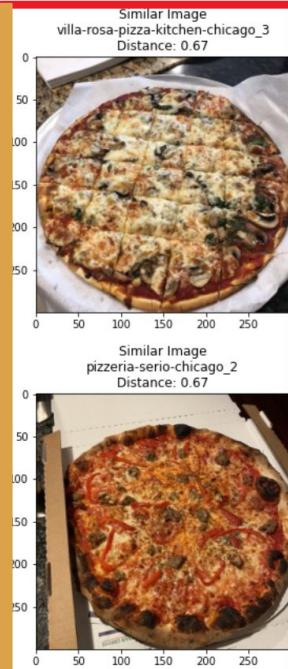
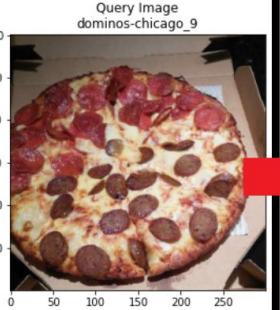
Pretrained Resnet

Provides the most consistently similar images

Pretrained
Resnet features
appeared to
most accurately
find similar
pizzas



There were still
a few troubling
outputs using
purely images



03



NLP

Text processing

Reviews were cleaned and prepared for NLP

- Combined reviews from each restaurant
- Only sentences about pizza
- Remove punctuation, numbers,
misspellings, stopwords

Natural Language Processing

- TF-IDF Vectorizer
- NMF Topic Modeling

TF-IDF

- **TF-IDF Vectorizer**
 1. Frequency of word in document
 2. Frequency of word across documents
 3. Each document is multi-thousand dimensional vector
- NMF Topic Modeling

Topic Modeling to find clusters and genres of pizzas

- TF-IDF Vectorizer
 - 1. Frequency of word in document
 - 2. Frequency of word across documents
 - 3. Each document is multi-thousand dimensional vector
- **Topic Modeling using NMF**
 - 1. **Cluster reviews into groups**
 - 2. **Identify topic by most common words**

These topics
were found
for the pizza
reviews

- TF-IDF Vectorizer
 - 1. Frequency of word in document
 - 2. Frequency of word across documents
 - 3. Each document is multi-thousand dimensional vector
- NMF Topic Modeling
 - Delivery
 - Italian
 - Deep Dish
 - Pizza Puffs
 - NY/Detroit
 - Tavern Style
 - Bar Food

04

Recommendations

Combining Efforts

Pipeline for the recommender system



User

Inputs an image and a description

Models

Extract features from the image and the description

Image Similarity

Find the 25 nearest neighbors to our image

Topic Similarity

Find the three most similar restaurants from the 25

About

This project was built from just under 1000 scraped restaurant in the Chicagoland area. The user reviews were used to create vectors across the pizza section for comparisons between pizzas.

This site was created by Ethan Feuerman. You can find him on [GitHub](#), [LinkedIn](#), [Behance](#) and his website [here](#).

Pizza-Vision

A few years ago, our favorite pizza place closed and ever since, my wife and I have not been able to find a new pizza that matched the same delicious style. So in attempt to find new pizza, I created the recommendation system that filters by similar images and then recommends based on similarity to user reviews.

To use this recommendation, try adding an image and a description of the pizza you want. Try to think about the style, the crust type, flavors, and more in your description.

You must add text and an image to get a recommendation.

Enter a accurate sentence (the more the better) to describe your pizza:

I want a pizza that is a very thin, but still chewy crust. It should be cut in slices and have a thin

Upload + Classification Example

Choose an image...



Drag and drop file here
or click to select file - 8MB

Browse files

Manage app

Next

- 
- Possible image improvements:
 - Higher quality
 - More consistent
 - More images
 - Use location data to help narrow results

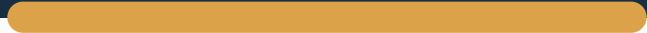
Pizza Trials #1

Crushed

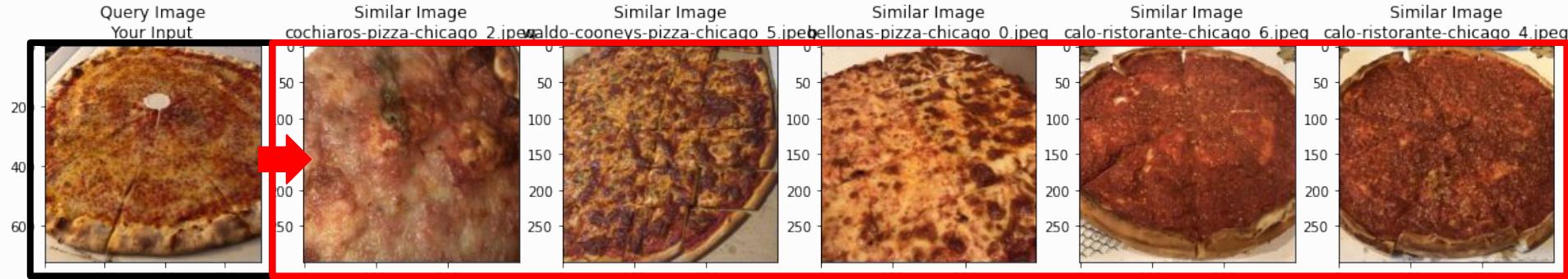


Pat's

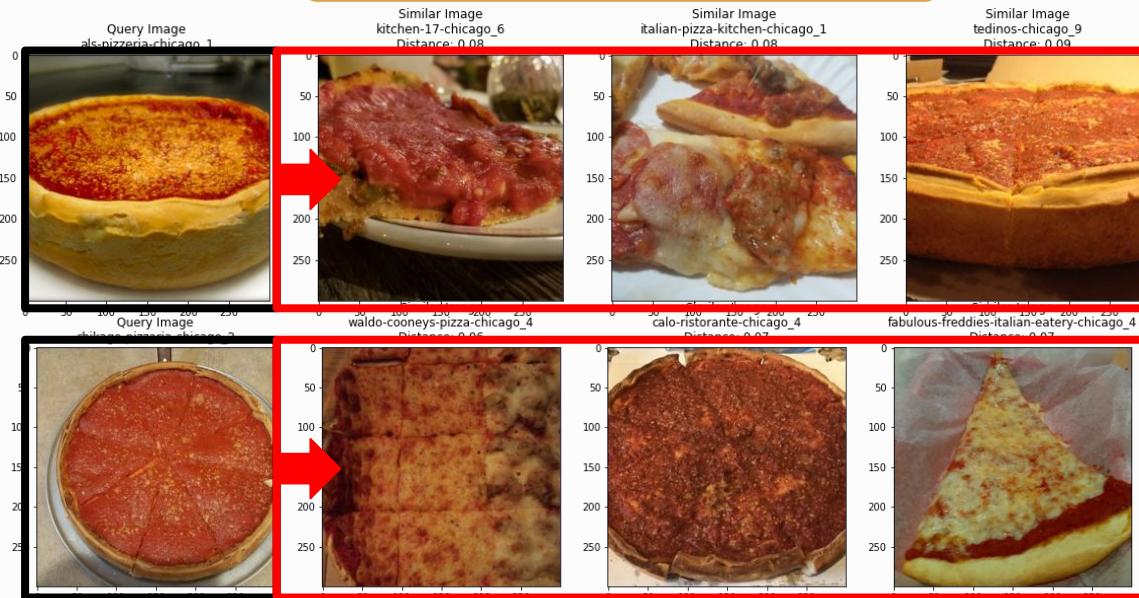
Appendix



Autoencoder features did not meet the eye test



Neither did the Fine Tuned Resnet features



TSNE



TSNE

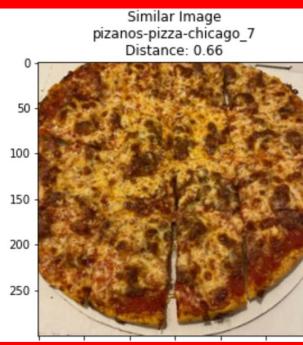
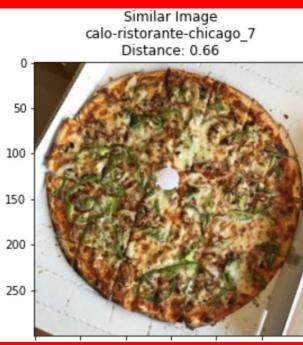
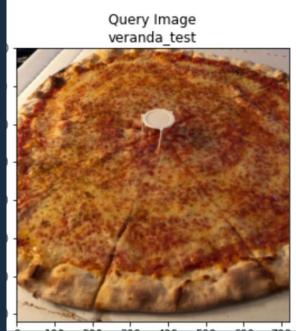


```
['bellonas-pizza-chicago_0.jpeg',  
 'lonnies-pizzaria-chicago_5.jpeg',  
 'calo-ristorante-chicago_4.jpeg',  
 'cochiaros-pizza-chicago_2.jpeg',  
 'giordanos-chicago_4.jpeg']
```

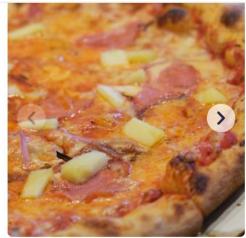


Autoencoder

Goal Pizza



Restaurants



1. Craft Pizza



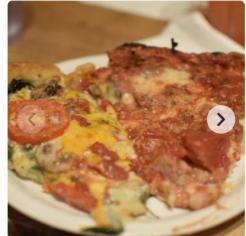
\$\$ • Pizza, Salad, Italian

✓ Delivery ✓ Takeout ✓ Outdoor seating

"**Pizza** is a 7/10 and is really good! It's super greasy tho so bring a napkin. I LOVE the amount" [more](#)

[Start Order](#)

Offers takeout and delivery



2. Lou Malnati's Pizzeria



\$\$ • Pizza, Italian, Sandwiches

✓ Delivery ✓ Takeout ✓ Outdoor seating

" and preordered our **pizza** (that's a thing there...just go with it). She said, "Good choice." When I travel" [more](#)

[Start Order](#)

Offers takeout and delivery



3. Piece Brewery and

(773) 772-4422

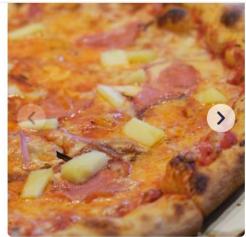
1027 W North Ave



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Restaurants



1. Craft Pizza



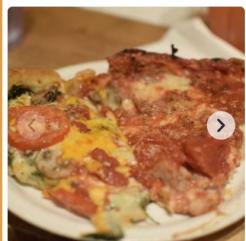
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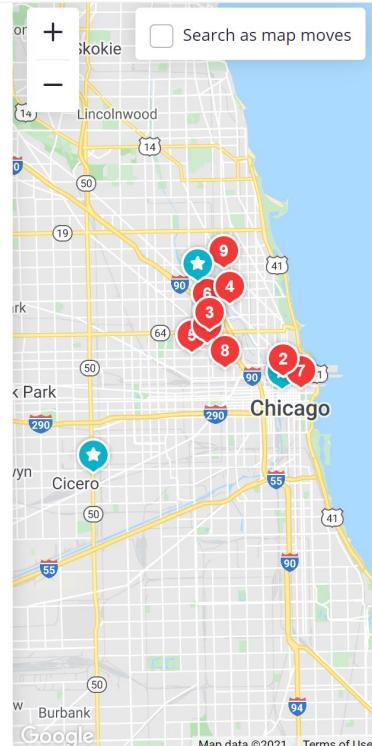
Offers takeout and delivery



3. Piece Brewery and

(773) 772-4422

1027 W North Ave



Reviews



- Combined reviews from each restaurant
- Only sentences about pizza
- Remove punctuation, numbers, misspellings, stopwords

NLP



The pizza you liked from: Apart pizza.

Based on your input pizza I recommend you try:

Phil's Pizza located at 1102 W 35th St, Chicago, IL 60609

RoccoVino's Italian Restaurant located at 11255 W 143rd St, Orland Park, IL 60467

Aurelio's Pizza - Woodridge located at 6430 Main St, Ste 130

Images



- Autoencoder
 - Resnet
- Finetune Resnet

Goals



- Finetune Resnet on Thick/Thin Pizza Classes
 - Trained this weekend, but working on extracting features
- Combine NLP/Images to one recommendation system
- Streamlit App?

Awesome Words





A picture always reinforces the concept

Images reveal large amounts of data, so remember: use an image instead of a long text

A picture is
worth a
thousand
words



Awards



Mercury

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



Venus

Venus has a beautiful name and is the second planet from the Sun. It's terribly hot

Our philosophy

Venus



Venus has a beautiful name and is the second planet from the Sun

Mercury



It's the closest planet to the Sun and the smallest in the Solar System

Jupiter



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

Summary

Do you know what helps you make your point clear? Lists like this one:

- They're simple
- You can organize your ideas clearly
- You'll never forget to buy milk!

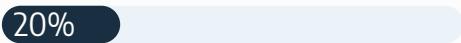
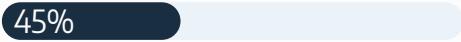
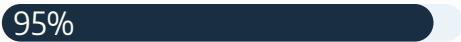
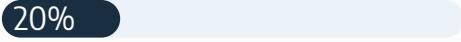
And the most important thing: the audience won't miss the point of your presentation

Company numbers

4,495,300,77

Big numbers catch your audience's attention

Benefits



Jupiter

It's the biggest planet in the Solar System

Mars

It's a cold place. It's full of iron oxide dust

Venus

It has a beautiful name, but it's terribly hot

Project updates

Projects bagged

Project	Name 1	Name 2	Name 3	Name 4
Amount	10k	20k	10k	5k
Project	Name 1	Name 2	Name 3	Name 4
Amount	10k	20k	10k	5k

Projects in hand

Project	Name 1	Name 2	Name 3	Name 4
Amount	80k	1.5M	40k	9k
Project	Name 1	Name 2	Name 3	Name 4
Amount	80k	1.5M	40k	9k

Projects lost

Project	Name 1	Name 2	Name 3	Name 4
Amount	50k	45k	70k	5k
Project	Name 1	Name 2	Name 3	Name 4
Amount	50k	45k	70k	5k

Our service

Saturn

Saturn is a gas giant and has several rings

Neptune

Neptune is the farthest planet from the Sun

Jupiter

It's the biggest planet in the Solar System

Venus

It has a beautiful name, but it's terribly hot

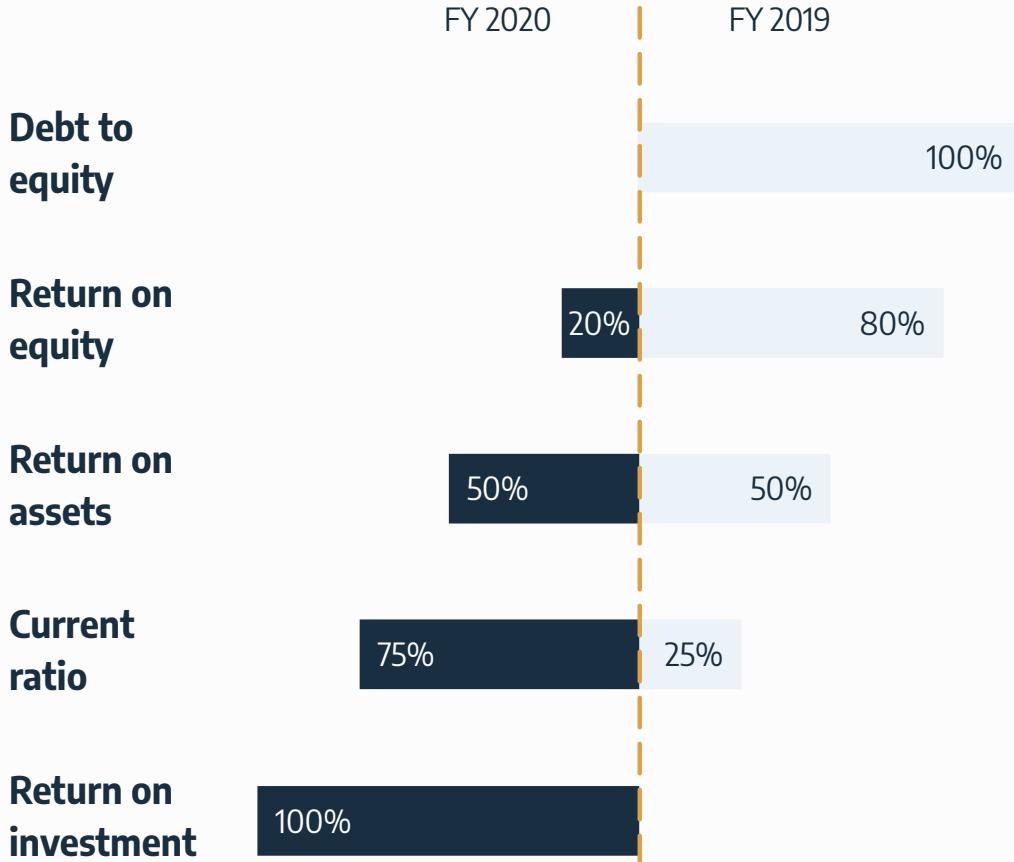
Mars

It's a cold place. It's full of iron oxide dust

Mercury

It's the smallest one in the Solar System

Financial ratios



Customer reviews



Sarah Patterson

“It’s the closest planet to the Sun and the smallest one in the Solar System”



John Patt

“It has a nice name and is the second planet from the Sun. It’s terribly hot”



Jane Doe

“Despite being red, Mars is a cold place. It’s full of iron oxide dust”

Case study



Mercury

It's the closest planet to the Sun and the smallest one



Venus

It has a beautiful name and is the second planet



Mars

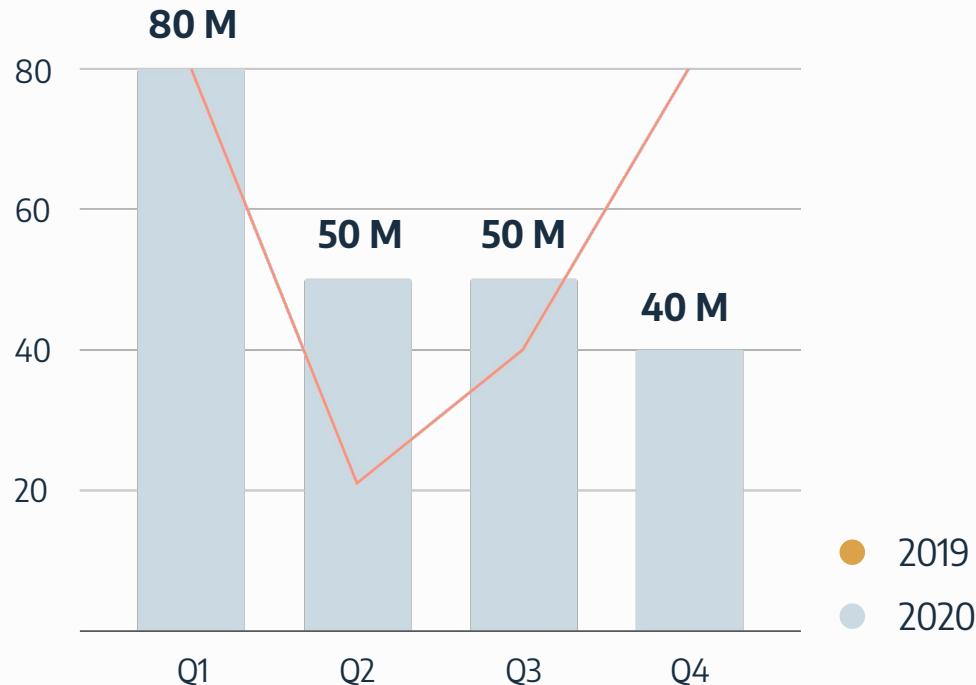
Despite being red, Mars is actually a cold place



Neptune

Neptune is the farthest planet from the Sun

Analysis of revenue



To modify this graph, click on it, follow the link, change the data and paste the new graph here, replacing this one

Future expansion



May 2020

Chicago (USA)



June 2021

Brasilia (Brasil)



April 2023

Moscow (Russia)

SWOT analysis

S

Strength

It's the closest planet to the Sun and the smallest one

W

Weaknesses

It has a beautiful name and is the second planet

O

Opportunities

Despite being red, Mars is actually a cold place

T

Threats

Jupiter is the biggest planet in the entire Solar System

Key milestones



Positioning map



Our company's numbers

333,000.00

Earths is the Sun's mass

24h 37m 23s

Is Jupiter's rotation period

386,000 km

Distance from the Moon

Our team



John Doe

You can replace the image on
the screen with your own



Sarah Patt

You can replace the image on
the screen with your own

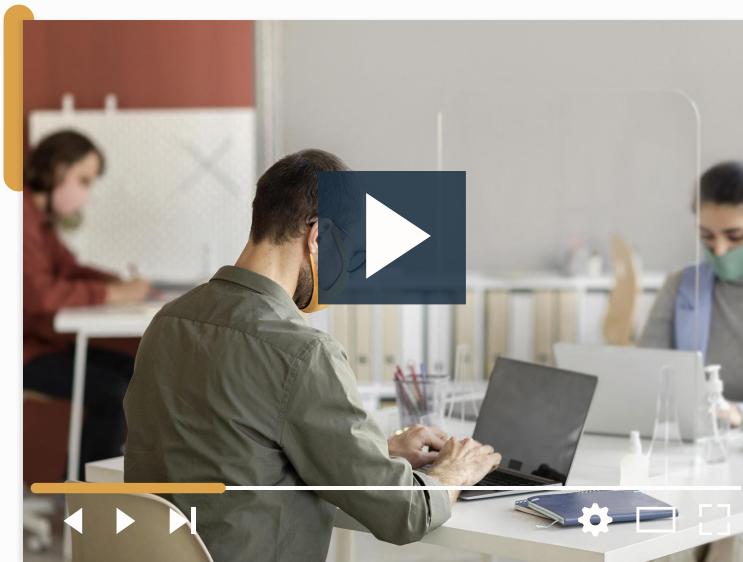


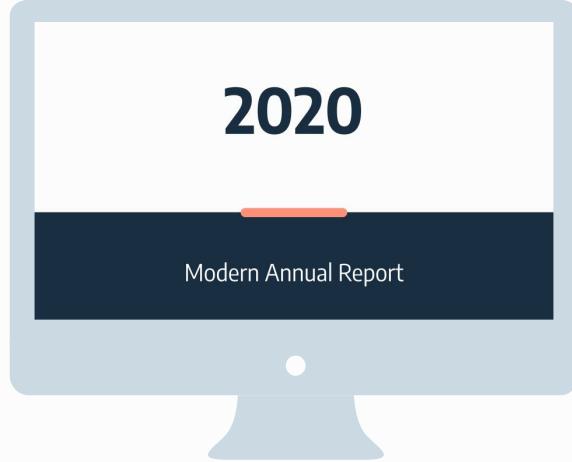
James Doe

You can replace the image on
the screen with your own

Multimedia

If you want, you can insert your multimedia content here





Desktop software

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



Mobile web

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



Tablet app

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Thanks

Do you have any questions?
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- Flat-lay-office-desk-assortment
- Still-life-wooden-bricks
- Two-colleagues-touching
- Man-office-during-pandemic-working
- Men-working-during-pandemic
- Woman-having-presentation-office
- Business-video-call-tablet
- Businessman-playing-jenga
- Two-coworkers-touching-elbows
- Front-view-woman-working-laptop
- Front-view-man-reading-paper
- Businesswoman-wearing-reading-glasses
- Young-female-with-paper-cup-office
- Multiracial-employees-working-laptop

Resources

Photos

- People-office-during-pandemic
- Two-people-working-together
- Portrait-young-businessman-holding-pen
- Young-businessman-standing
- Portrait-confident-young-businesswoman
- Co-workers-wearing-face-mask-office

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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

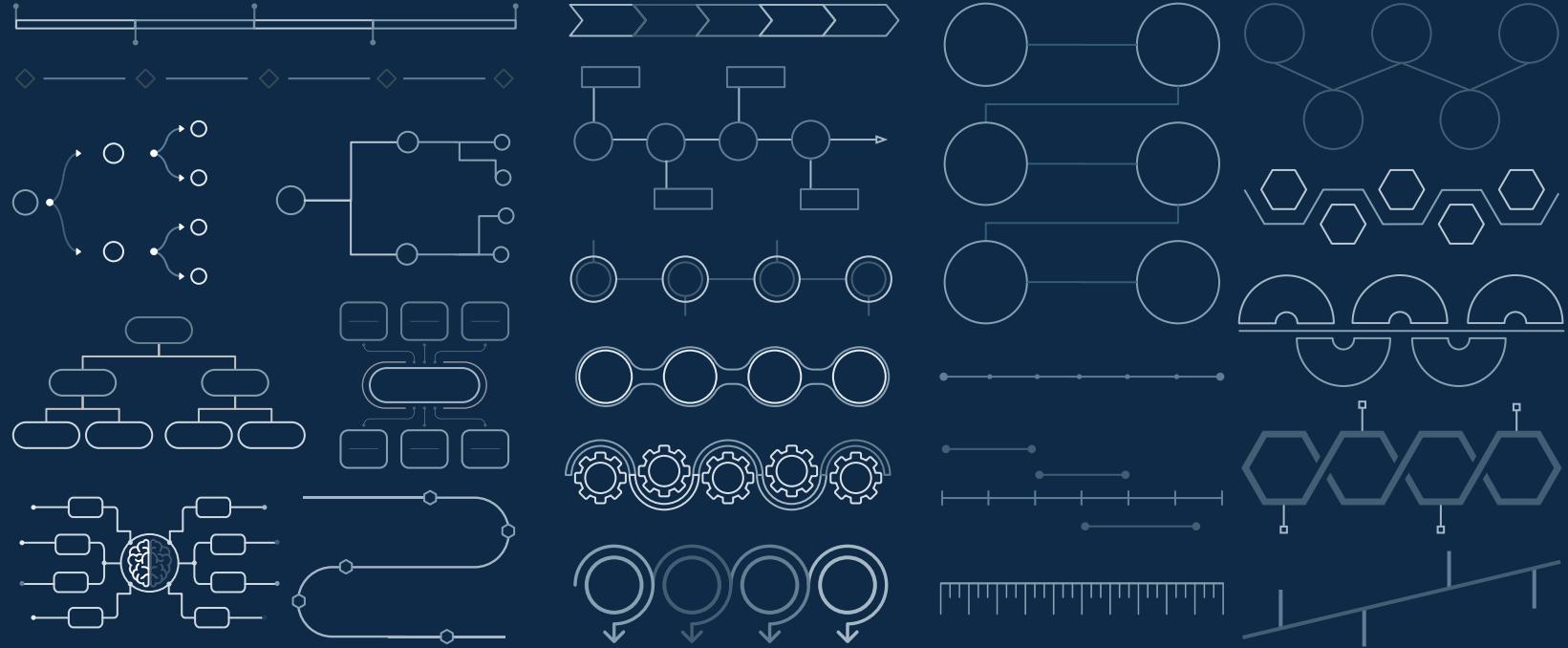
Use our editable graphic resources...

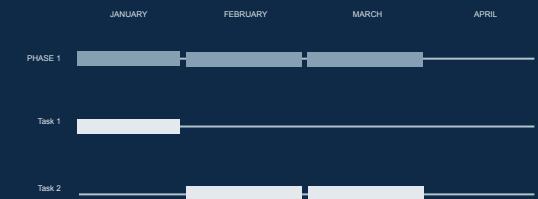
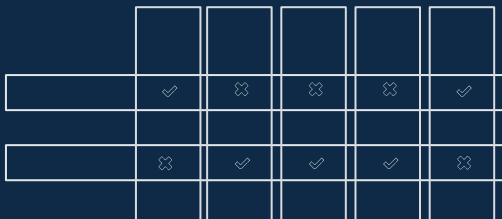
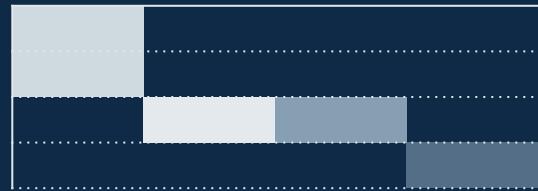
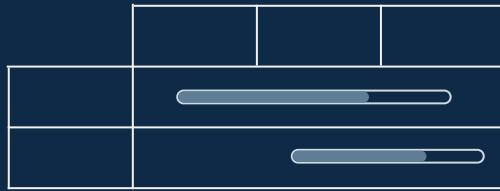
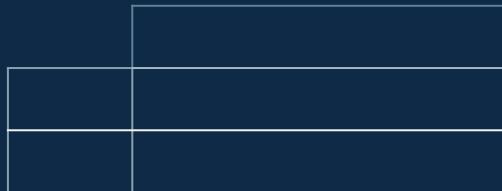
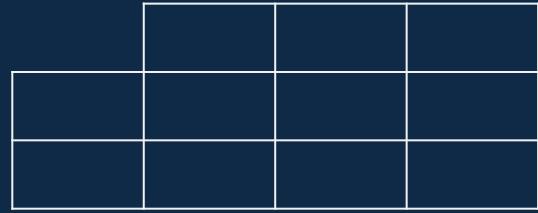
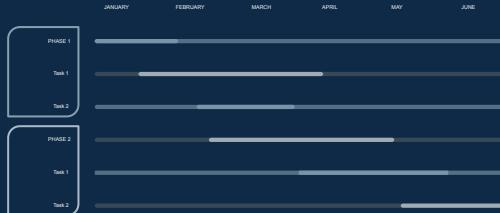
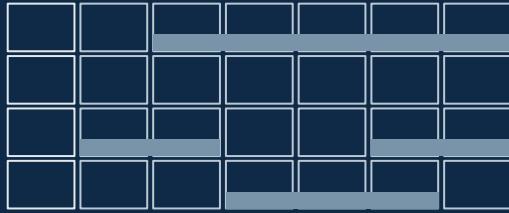
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Group the resource again when you're done. You can also look for more infographics on Slidesgo.

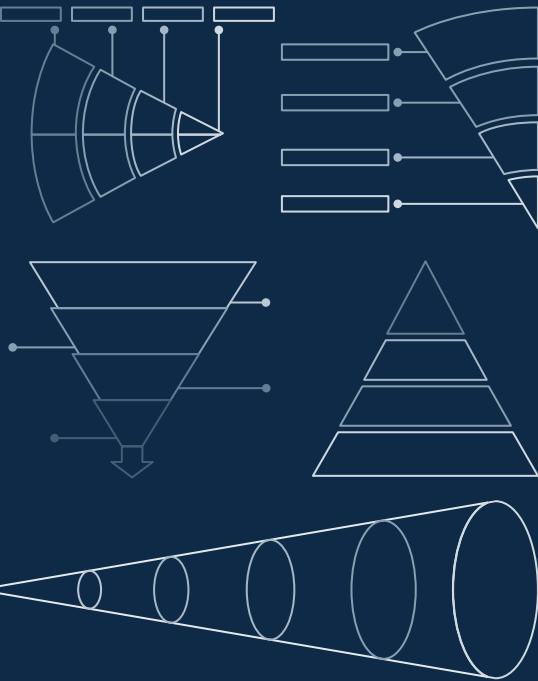
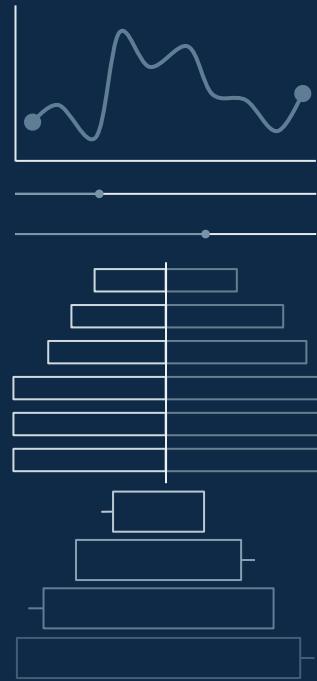
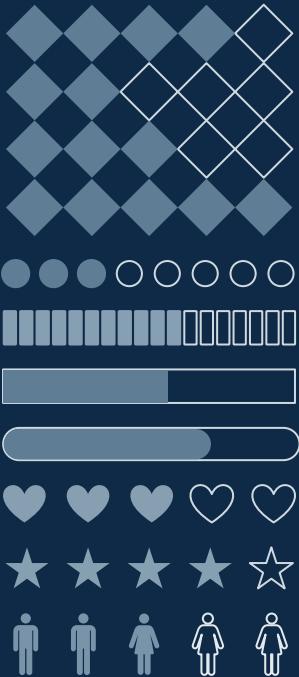
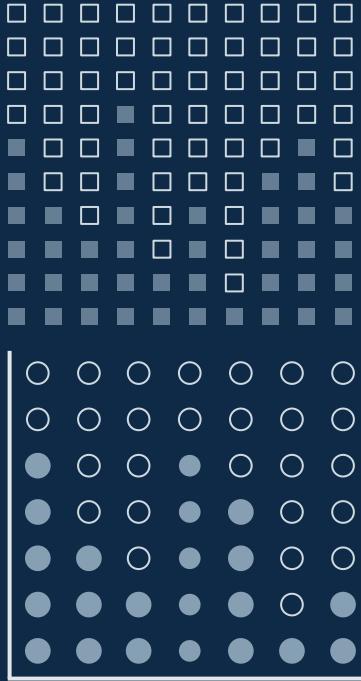












...and our sets of editable icons

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



