



Happy Almana

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- Thank you for coming today.
- We appreciate your joining us to watch our presentations.
- Today my fellow colleagues and I would like to present our Capstone Project.
- We're going to share our findings about Happiness across the World..



01

INTRO



02

EDA



03

MODELS



04

BONUS



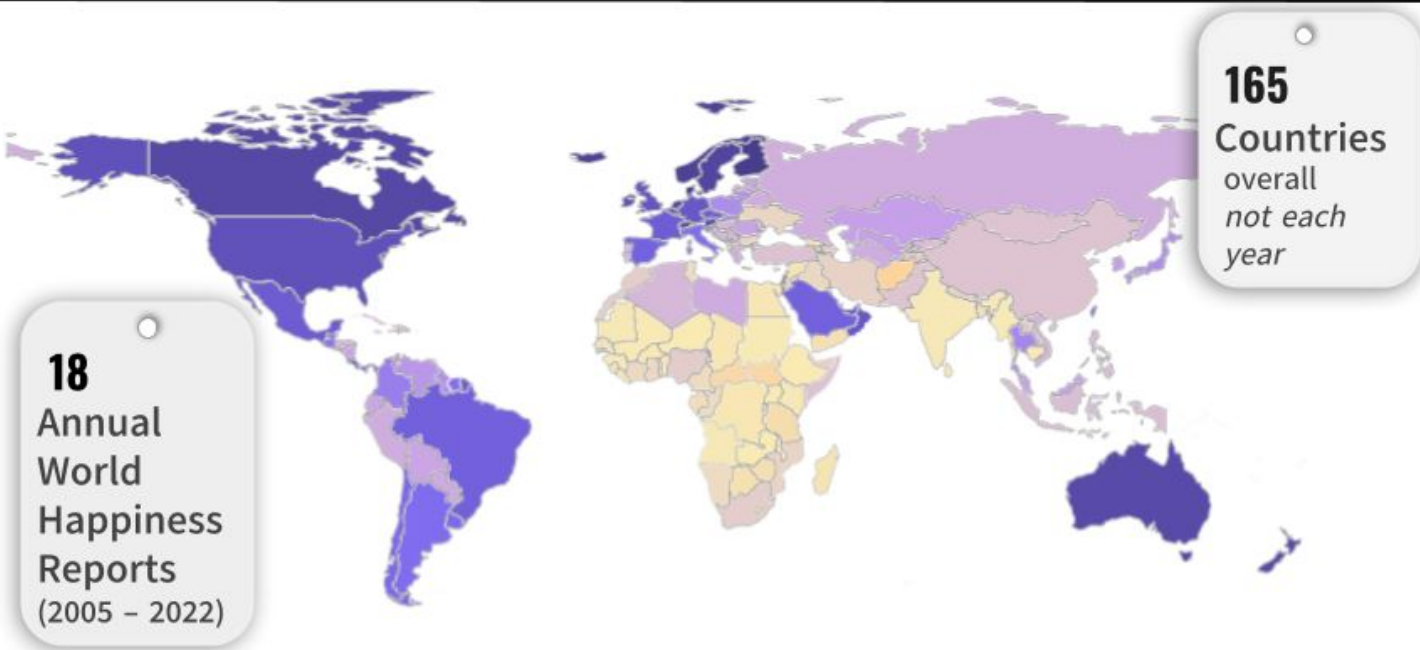
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OUTLOOK

SLIDE 2 – CONTENTS

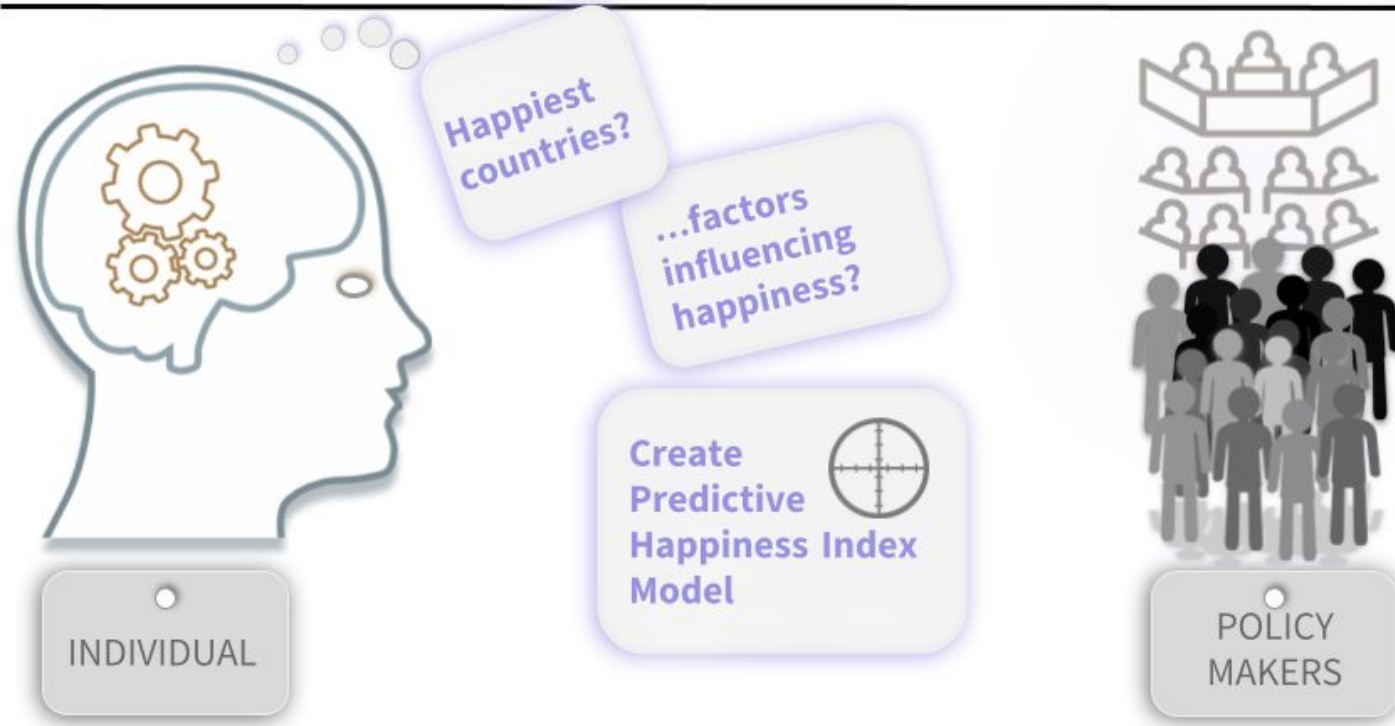
- Here are the sections of our presentation. proceeds as follows:
- We'll start off with an Introduction
- Then move on to Exploratory Data Analysis or EDA
- Then we look into our Models
- Next we have a little Bonus for you
- Finally we end with the Outlook for further research and on future developments

Intro: World Happiness Report



- I'm going to give you a general overview of the data, of what we're going to be exploring today
- We took the data used for the World Happiness Report
- Which comes out once a year
- The time period of data is 18 YEARS, 2005 to 2022
- Overall, 165 countries have participated but not every year
(195 RECOGNIZED COUNTRIES, ROUGHLY 84% OF TAKE PART)

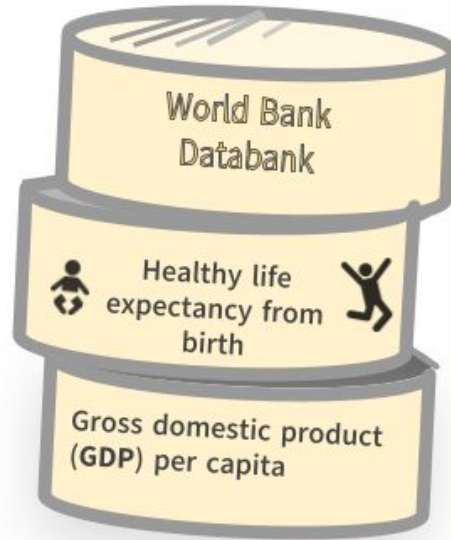
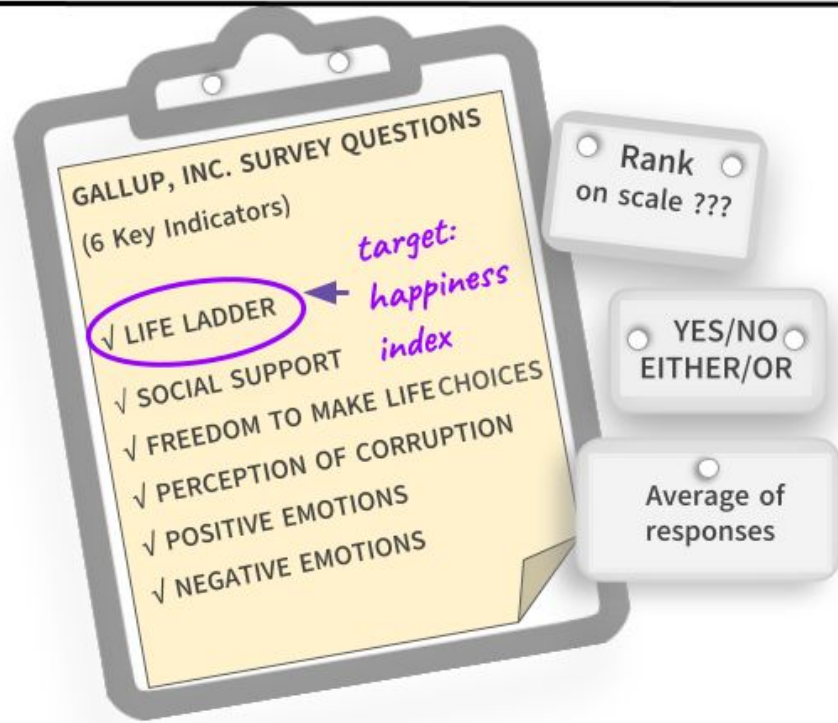
Aiming & Framing: World Happiness Report



SLIDE 4 - Aiming & Framing the World Happiness

- Happiness matters to everyone
- On the individual level, we all seek to find happiness.
- On a national level, happiness is also of interest.
- Policy makers of the differing governments want happy productive citizens.
- It ensures the well-being of the nation
- Naturally questions arose about happiness
- Where are folks the happiest, in which countries? Then further: what factors have an influence on happiness levels?
- Hence we aimed to set out to Create a Predictive Model for the Happiness Index

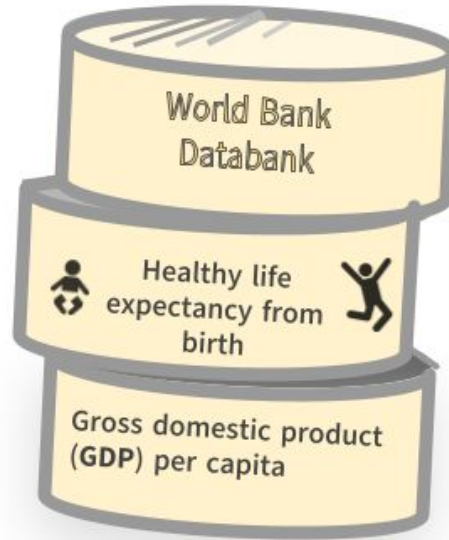
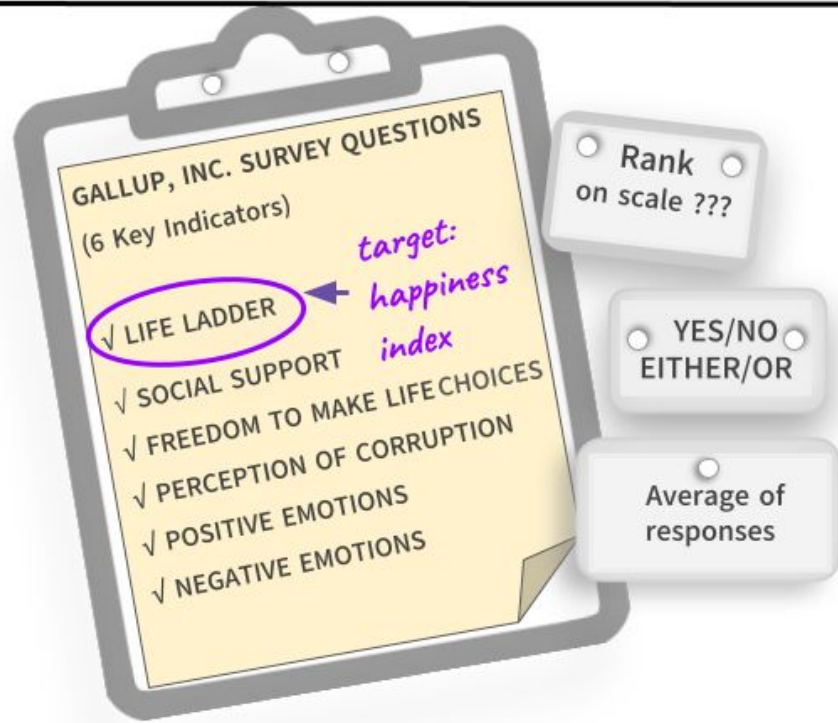
Features: World Happiness Report



SLIDE 5 - FEATURES (1/3) :

- Let's get to know the features of the dataset:
- The World Health Report is based on surveys from the Gallup World Poll and data from the Worldbank Databank.
- The questions asked the respondents to rank or give a yes/no answer.
- The average of their answers were then tallied up for each country.
- First off, we have the life ladder or happiness index which is our target or what we want to predict.

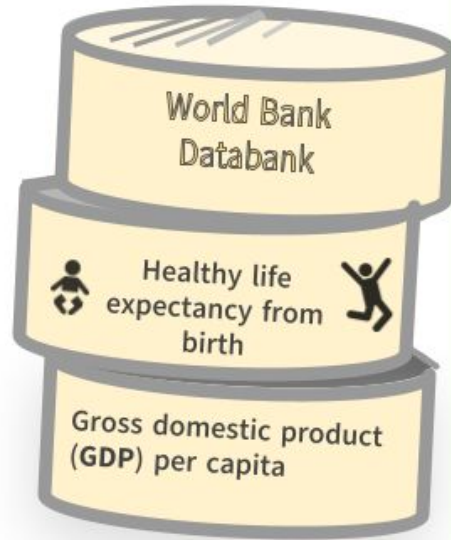
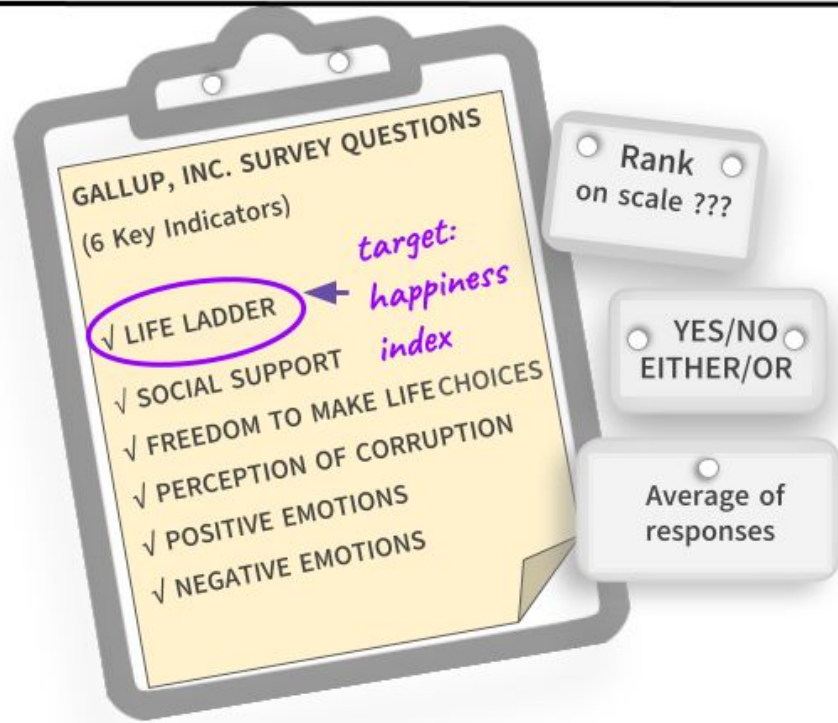
Features: World Happiness Report



SLIDE 5 - FEATURES (2/3) :

- *Social Support* refers to whether or not you have got someone to count on in times of trouble.
- *Freedom to Make Life Choices* is the response to the question: "Are you satisfied or dissatisfied with your freedom to choose what you do with your life?"
- *Perception of Corruption*: "Is corruption widespread throughout the government and businesses or not?"
- *positive Attitude* : "have you experience a lot of positive emotions (laughing, enjoyment, learning something interesting) yesterday?"

Features: World Happiness Report



SLIDE 5 - FEATURES (3/3):

- *negative Attitude*: "have you experienced a lot of negative emotions yesterday (worry, sadness, anger)?"
- Factual data about the countries are based on info from the worldbank
- *Healthy_life_expectancy_at_birth*: The Average number of years that a person can expect to live in "full health"
- *Gdp_per_capita*: shows the health of a country's economy. It is the total value of the goods and services produced in a country during a specific period of time, usually a year.

Happiness Index a.k.a. “Life Ladder”



Question Asked:

Please imagine a ladder

with steps

numbered from 0 at the bottom

to 10 at the top.

SLIDE 6 - LIFE LADDER

- The Happiness Index or the Life Ladder (as I mentioned in the slide before) is the target or what we are aiming to predict
- How is it determined? The individual is asked the following:

“The top of the ladder 10 represents the best possible life for you and the bottom of the ladder 0 represents the worst possible life for you.

On which step of the ladder do you stand now in your opinion?”

Further Features Considered



Xtra
Data

✓ POPULATION DENSITY (Kaggle)
✓ AVERAGE YEARS OF SCHOOLING
(UN Development Index)
✓ COST OF LIVING *in USD*
(Numbeo)
✓ GINI INDEX *Wealth Distribution*
(World Health Report)

✓ CRIME INDEX (Numbeo)
✓ HEALTH CARE INDEX (Numbeo)
✓ ENVIRONMENTAL POLLUTION
INDEX (Numbeo)

- We brought in more variables.
We wanted to improve our model's performance.
- *Crime Index*: perception of crime
- *Health Care Index* is designed to reflect the quality of a healthcare system
- *Population Density*: people living per sqkm of country
- *Average years of school* for adult of age 25 years or more (from: Human Development Index)
- *Cost of Living Index* in USD

Further Features Considered

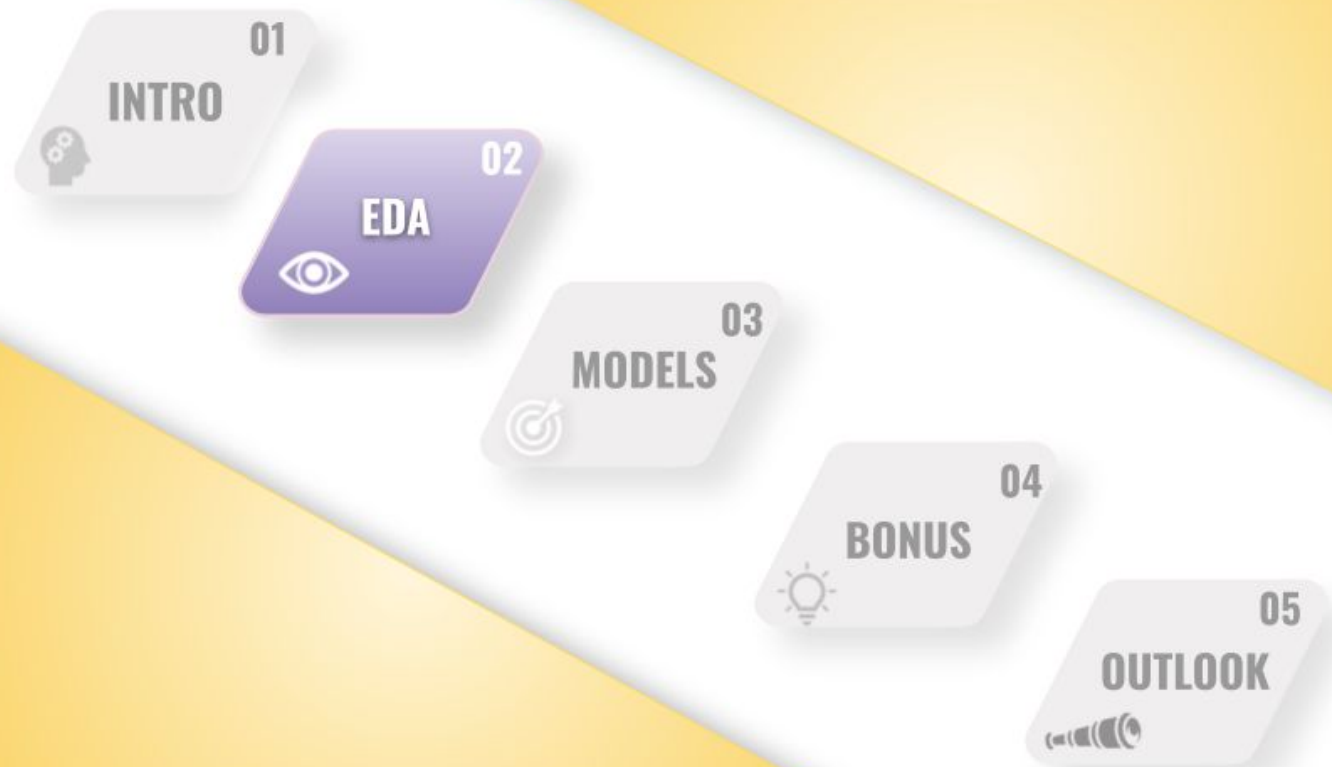


Xtra
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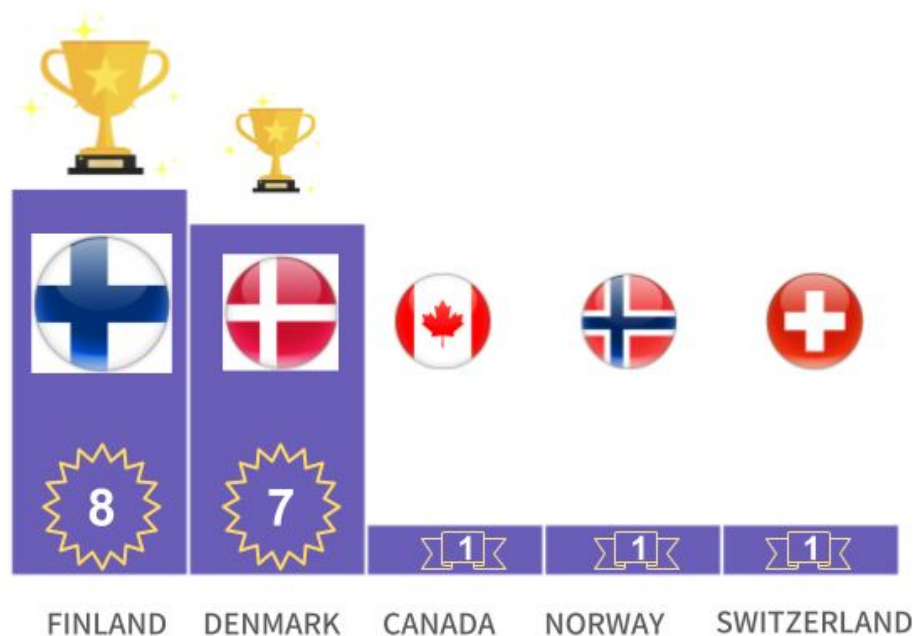
✓ CRIME INDEX (Numbeo)
✓ HEALTH CARE INDEX (Numbeo)
✓ ENVIRONMENTAL POLLUTION
INDEX (Numbeo)

- The *Gini index* measures Inequality of wealth distribution:
A Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality.
- *Environmental Pollution Index* from Numbeo



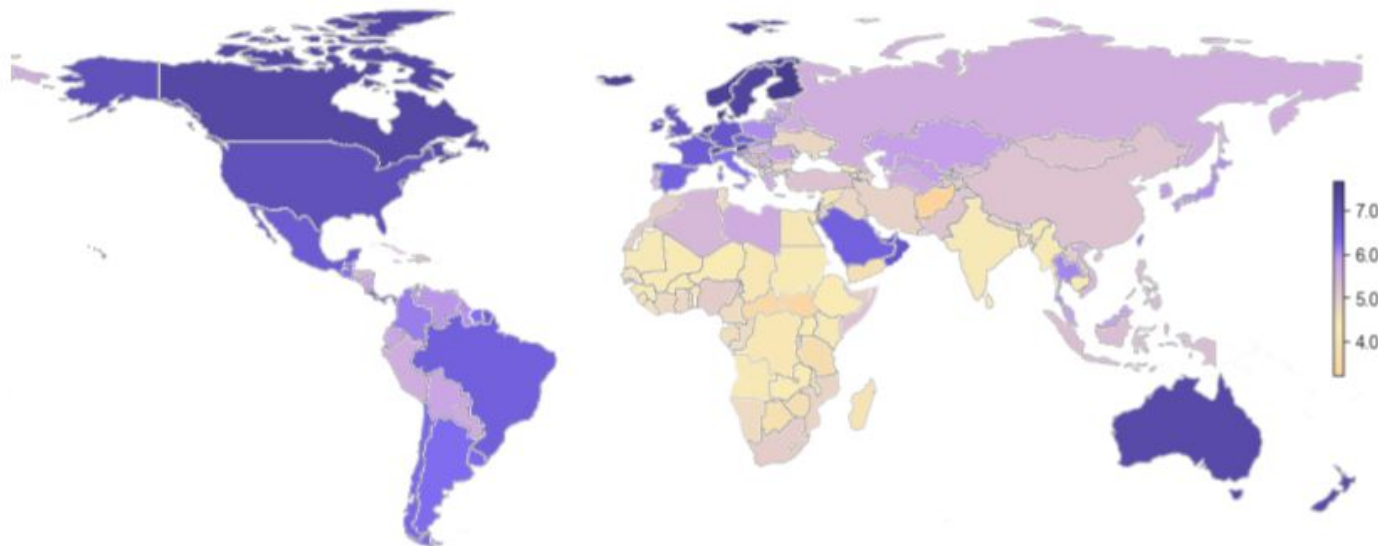
- I will now move on to exploratory data analysis (EDA) and show some results from the data

Happiest Countries, 1st Place Winners (2005-2022)



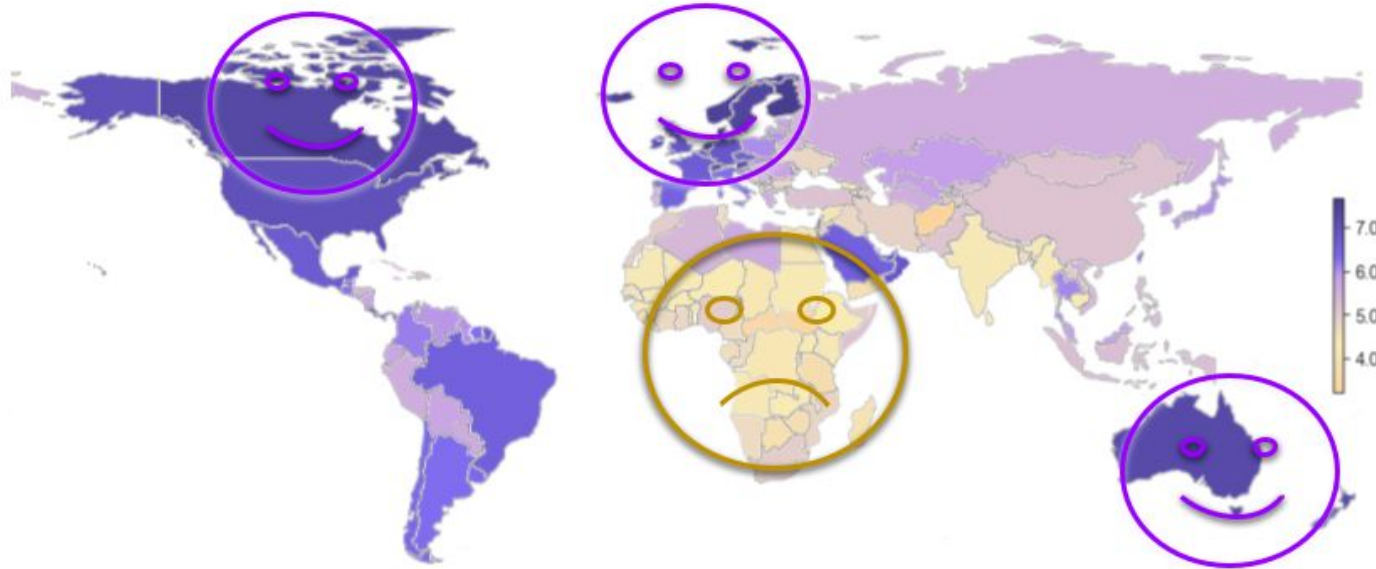
- You are probably wondering which countries are the happiest?
- On this Slide you can see the winners since 2005 to 2022.
- As you can see Finland & Denmark are the top countries in terms of happiness index.
- Finland has won 8 times and Denmark has won 7 times, whereas
- Canada, Norway and Switzerland have won just one time each.

Average Level of Happiness (2005-2022)



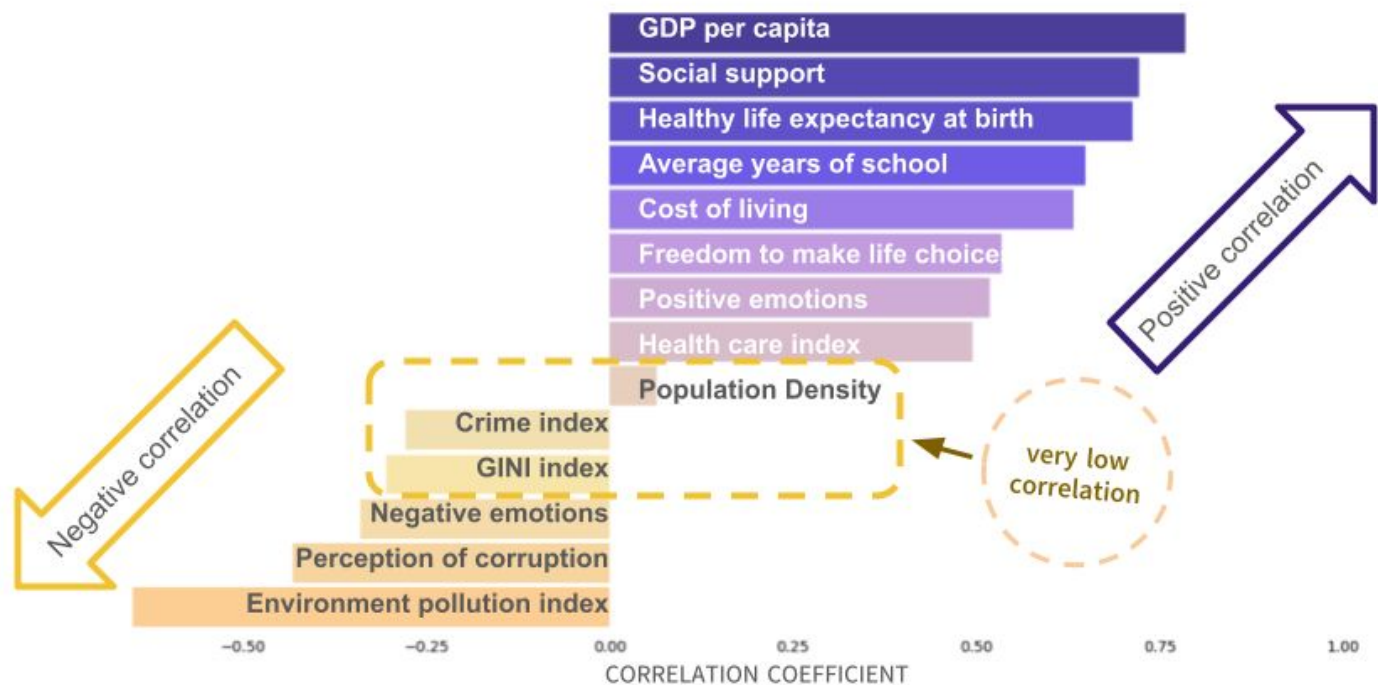
- Let's look where the happiest countries are.
- Since we didn't have all the data for each country and for every year, here we did an average over the whole time span to get an overview.
- The colour gradient represents the level of the Life Ladder.
- The darker the purple, the happier the country.
- The more yellow the country is, the lower the happiness index.

Average Level of Happiness



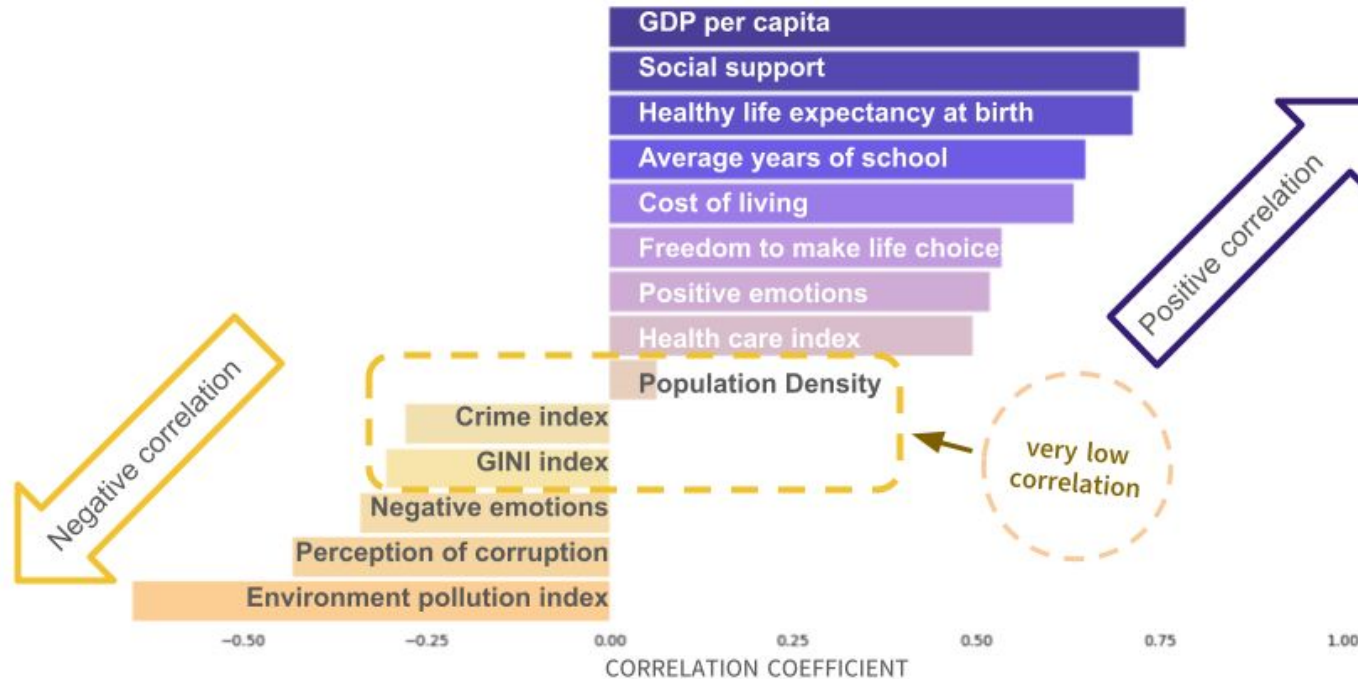
- As you can see, the happiest countries are to be found in northern Europe and in the north of America
- Australia and New Zealand are also among the happiest countries.
- If you look at the African continent, it is very yellow, which means that there are much less happy countries there.

Correlation to Life Ladder



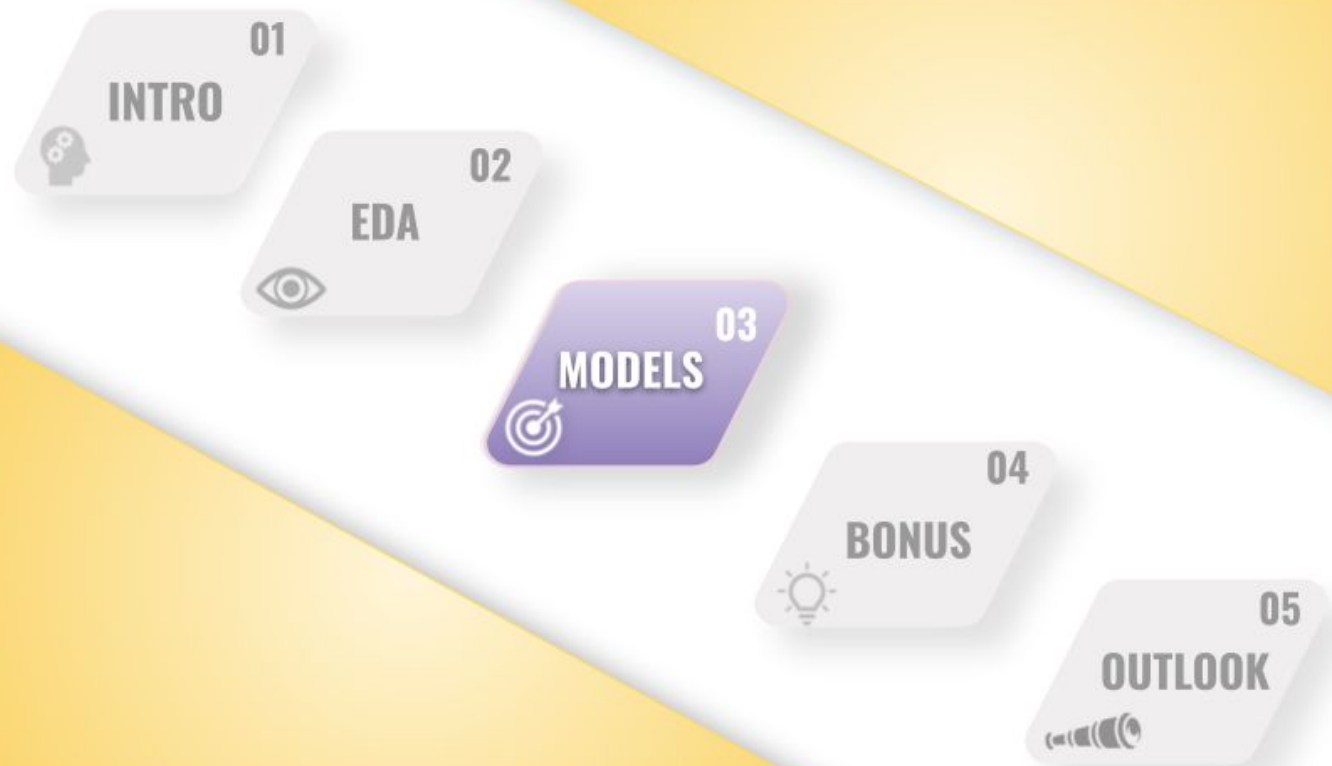
- Why are some countries happier than others?
- Which factors could lead to more happiness?
- On this slide you can see the correlation to Happiness Index (Life Ladder).
- The correlation coefficient is a number between 0 and absolute 1 (a negative value means that the variables are inversely related to each other)
- The coefficient indicates how strong the correlation between characteristics and Life Ladder is.
- The closer to 1, the stronger the correlation, the closer to 0, the weaker.

Correlation to Life Ladder



SLIDE 12 - CORRELATION TO LIFE LADDER (2/2)

- And here you can see that we have strong correlation between life ladder and GDP per capita, social support and Healthy life expectancy at birth.
- But we also have negative correlation between Environment pollution Index and the life ladder.
- We suspect the reason of the low correlations to the life ladder could be that we didn't have enough Data.
- Which features did we use to predict the target, which model did we use and how it performed, you will see on the upcoming Slides



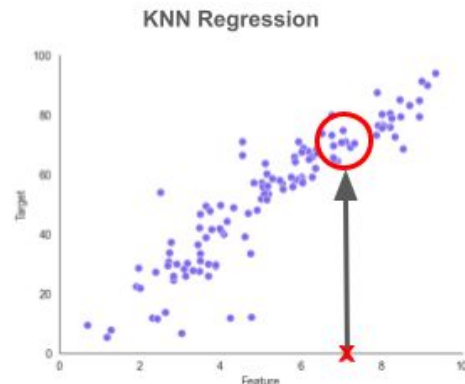
- I will now move on to Modelling Part and show:
 - which Algorithm we choose
 - Which variables we selected
 - And how well our model performs

Baseline Model



Variable: **GDP per Capita**

Algorithm: **K-Nearest-Neighbors (KNN)**



Model Performance

Average Errors	Base-model	Best Model
Absolut	0.52	🤔
Percentage	10.2%	🤔

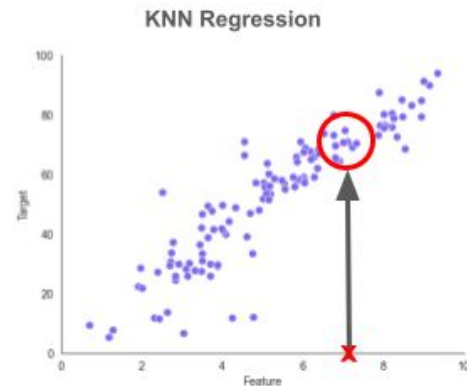
- We ran the base model with the variable with the highest correlation : GDP per Capita.
- We tried several algorithms and chose K-nearest neighbours (KNN). It performed best.
- The idea of the KNN algorithm is that similar things are nearby.
- So, the algorithm searches for a given number of neighbours of a datapoint, Then calculates the average of the neighbours And assigns this target value to the datapoint.

Baseline Model



Variable: **GDP per Capita**

Algorithm: **K-Nearest-Neighbors (KNN)**



Model Performance

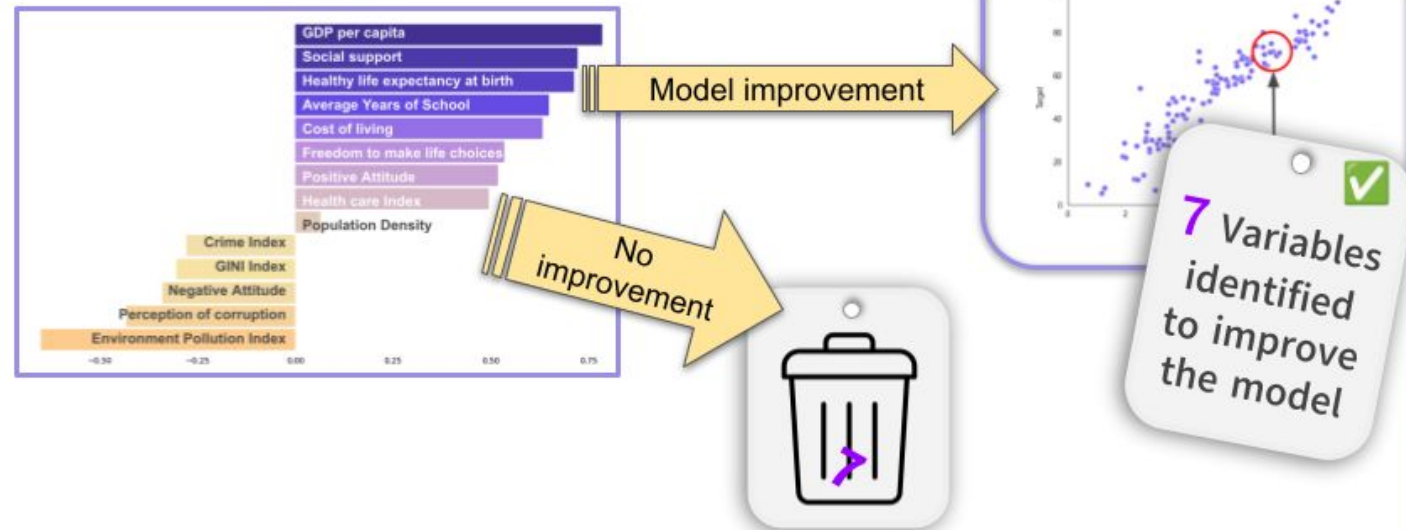
Average Errors	Base-model	Best Model
Absolut	0.52	🤔
Percentage	10.2%	🤔

- To evaluate how well our model performed we compared the average error between the predicted life ladder value and actual life ladder value.
- So that would be, namely the absolute error and the percentage error.
- Our Baseline Model has the absolute error of 0.52 and the percentage error of 10,2%
- There is room for improvement..

Sort Out the Variables ...



... separate the good from the bad

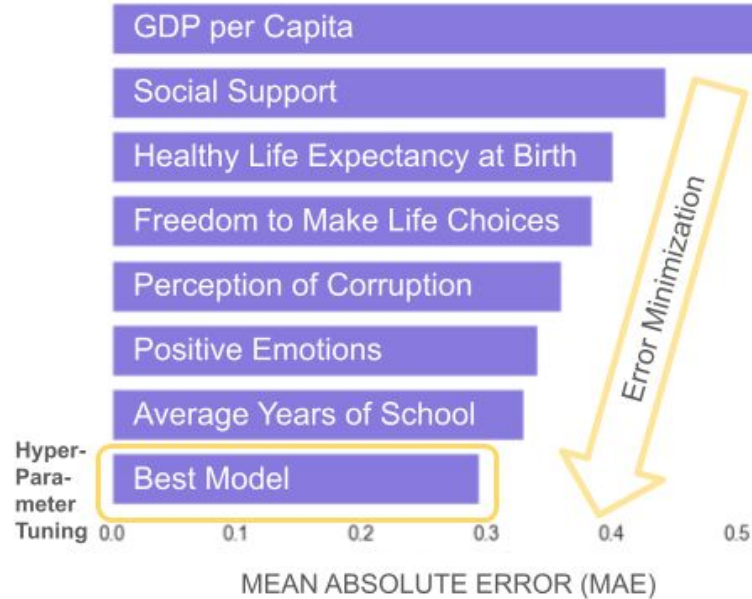


- ...depending on whether they improve the model or not.
- In the end we identify 7 Variables that made our model better.
- Let's take a closer look at those variables we decided to keep..

Best Performance Model



Variables added one-by-one:



Algorithm: KNN

Model Performance:

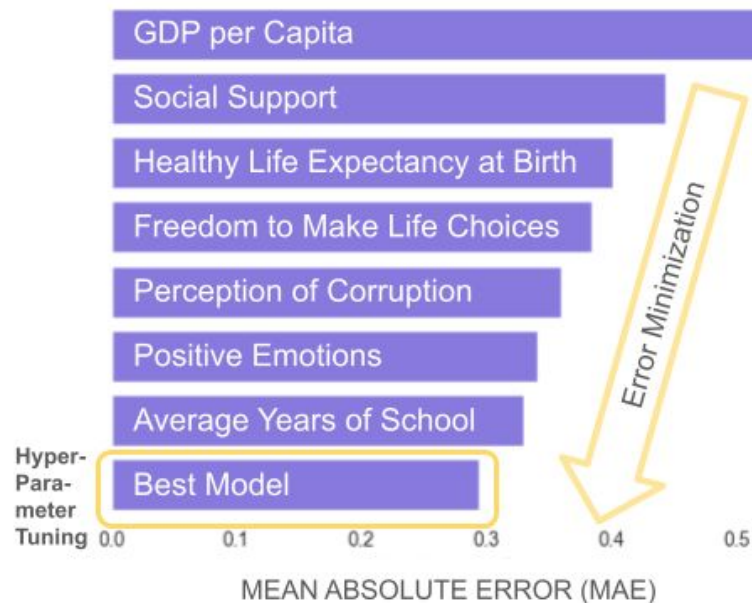
Average Errors	Base-model	Best Model
Absolut	0.52	0.29
Percentage	10.2%	5,9%

- We improved the model, that means we minimized the error for the prediction. The selected variables are:
 - GDP per Capita
 - Social Support
 - Healthy life Expectancy
 - Freedom to make Life Choices
 - Perception of corruption
 - Average Years of School
- Each time we added another variable the error decreased

Best Performance Model



Variables added one-by-one:

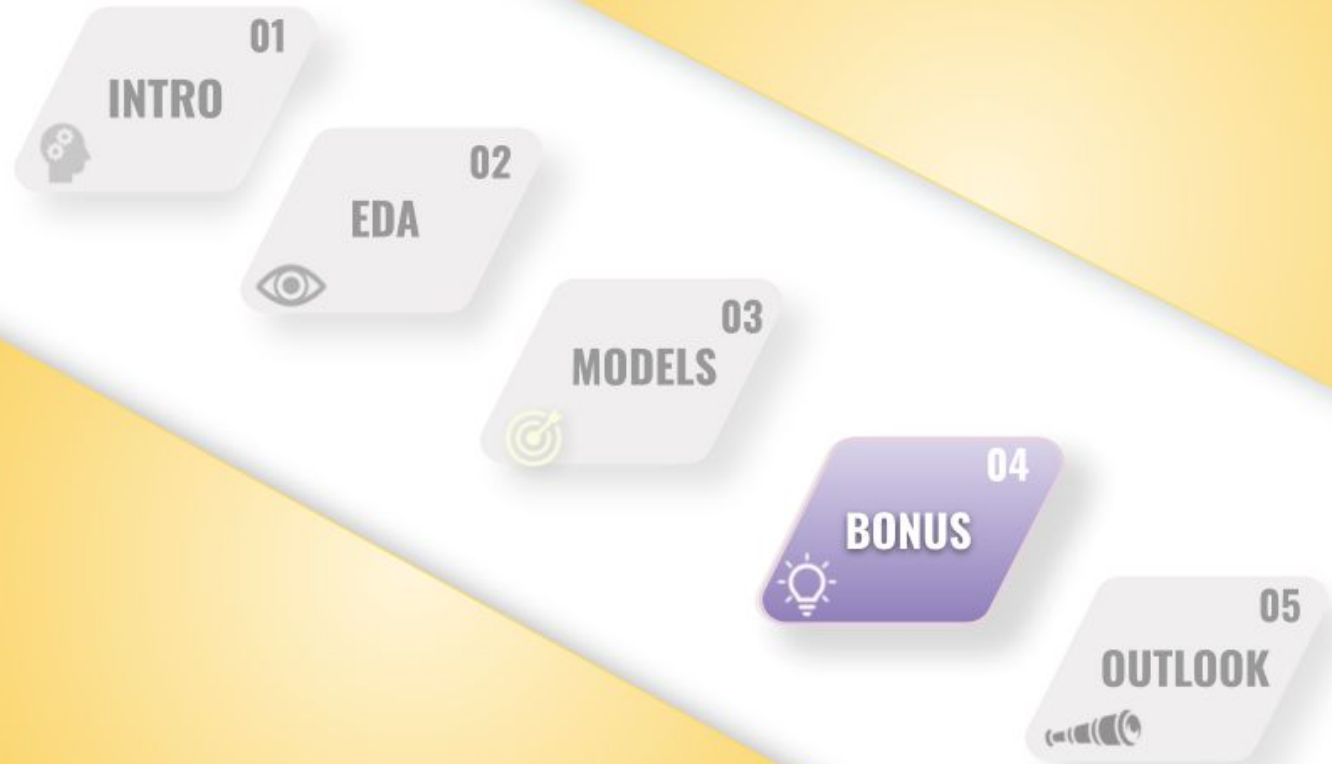


Algorithm: KNN

Model Performance:

Average Errors	Base-model	Best Model
Absolut	0.52	0.29
Percentage	10.2%	5,9%

- We stuck to KNN algorithm. It was superior to the the other algorithms we tried.
- In the Model Performance Table, you can see how we improved the model:
- The absolute error decreased from 0.52 to 0.29
- The percentage error decreased from 10.2% to 5.9%



- And now, We have a little bonus...

And then, while we were working...



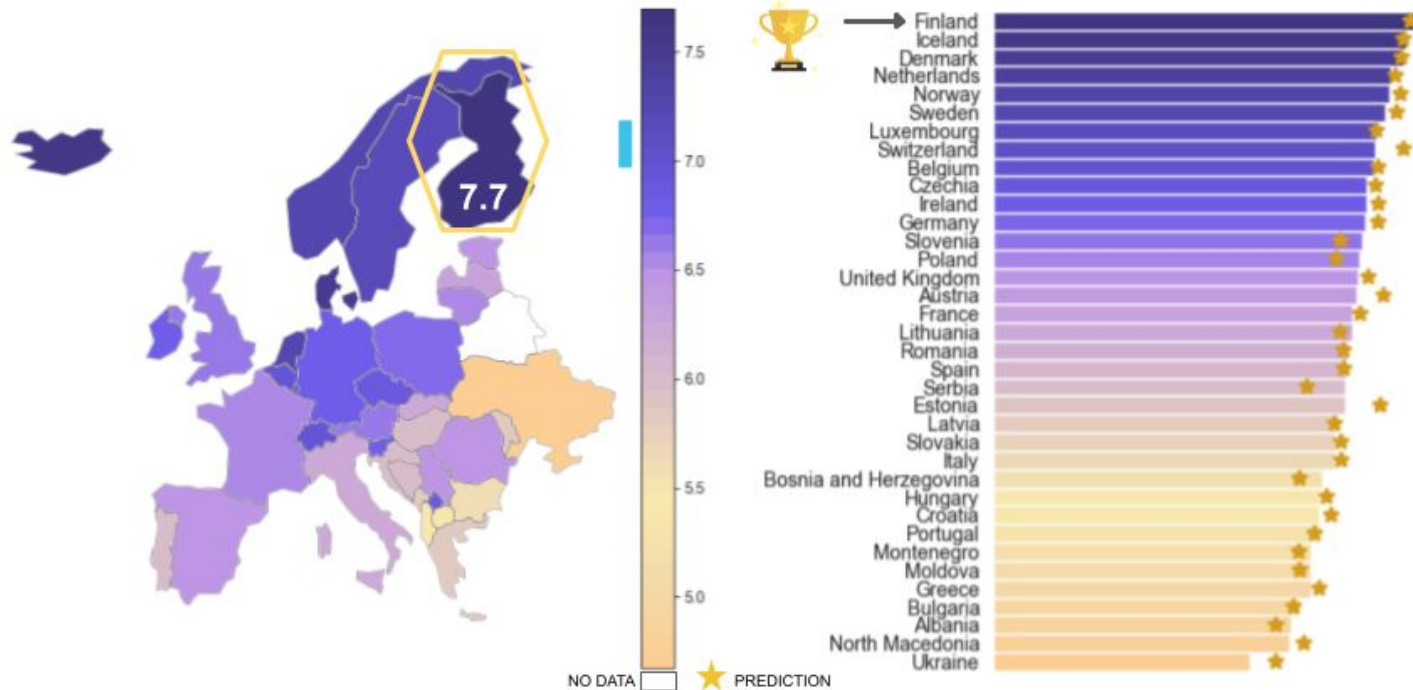
...on World Happiness Day, March 20th, 2024

... the Happiness Report for 2023 was released



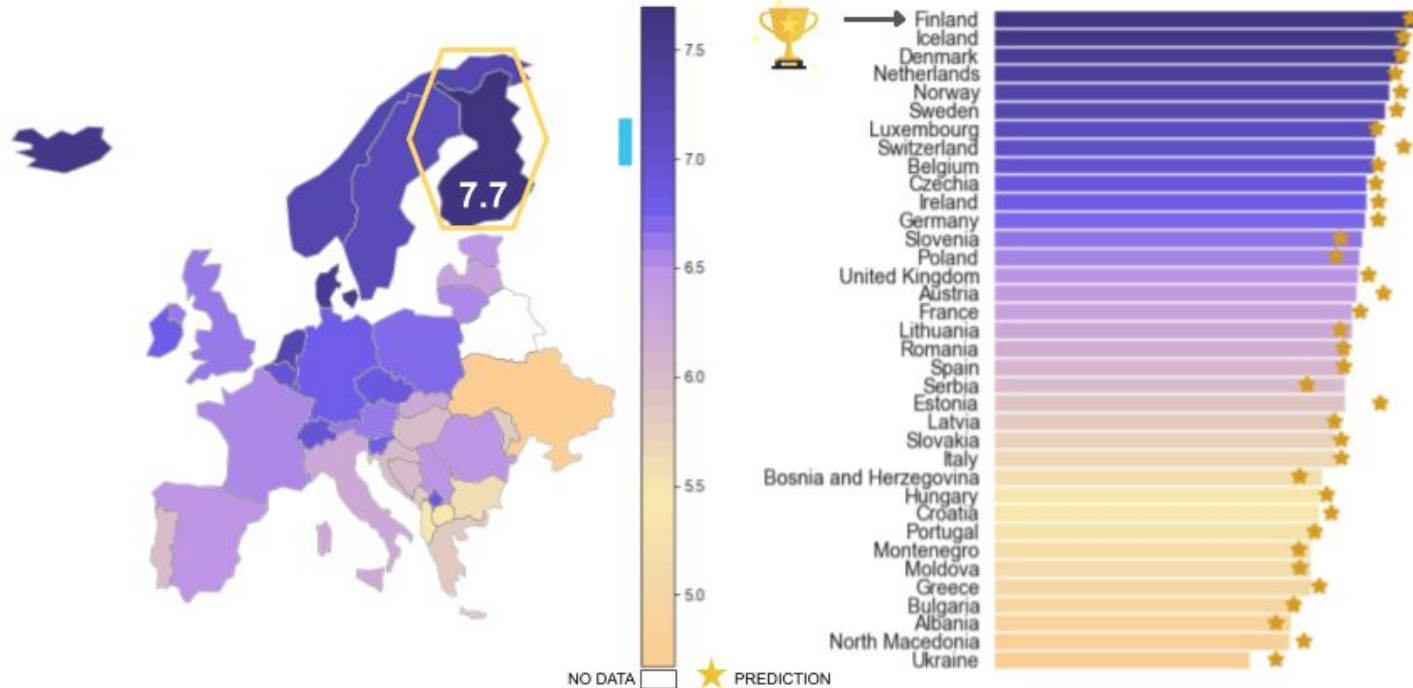
- During our project, on World Happiness Day, March 20th 2024, the new the Happiness Report for 2023 was released
- We took this data and looked at it.
- And we also used it to test our model.

Happiness Index in Europe, 2023

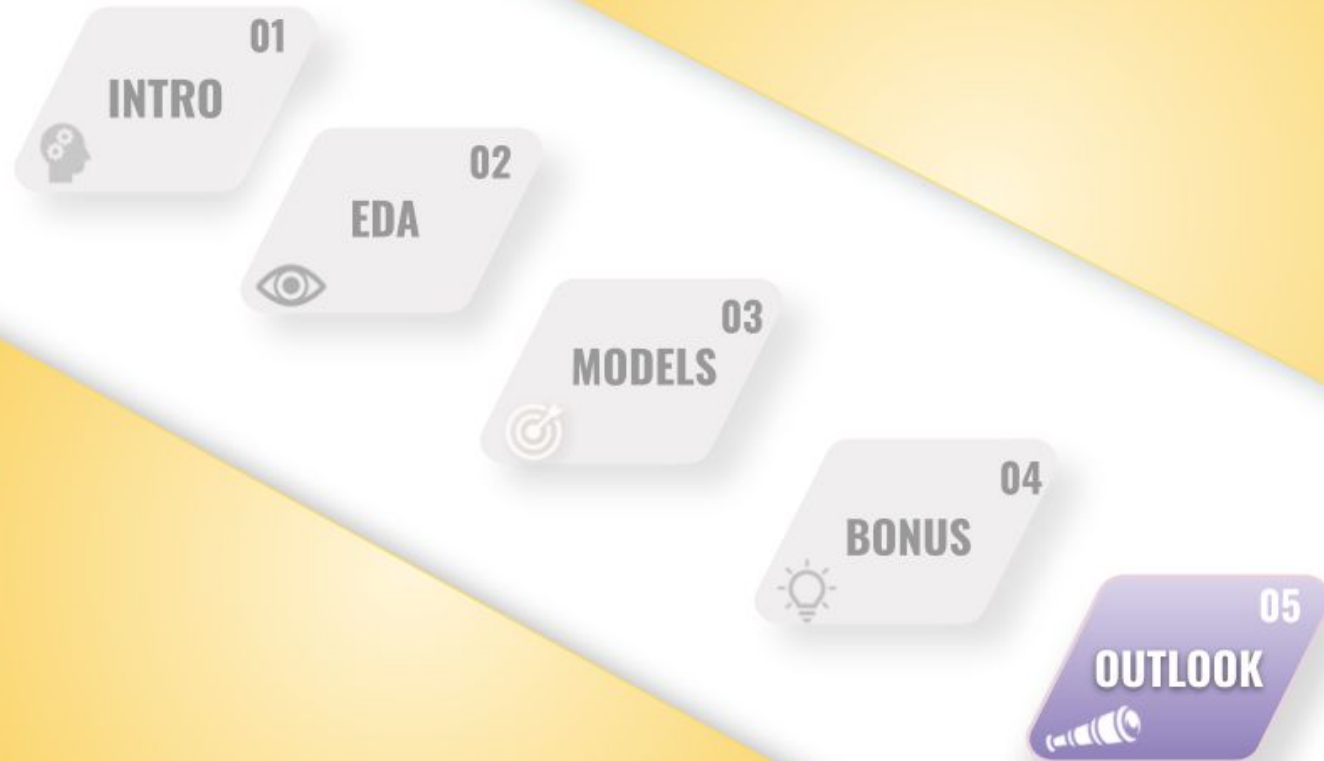


- The map on the left shows the countries of Europe, coloured according to the level of the Happiness Index.
- The colour gradient is in the middle of the picture, and you can see, The darker purple the country, the happier it is.
- The chart on the right shows the Happiness Index with bars.
- As we can see, Finland has won again this year with a happiness-index of 7.7.
- In 2nd place is Iceland and in third place is Denmark.

Happiness Index in Europe, 2023



- In the bar plot on the right side we have added our prediction with stars.
- As you can see, some indices we can predict more accurately, others less so.
- Overall, the average error for our model has not changed, even with the new data. It is still at 5,9%.
- So, our model also works well with new data



- And now, the last part contains a short summary and our outlook

Summary

Europe's Happiest Countries

DENMARK 

FINLAND 

Rest of the World's Happiest Countries

CANADA 

ISRAEL 

NEW ZEALAND 

7 Variables Enhancing Model Performance

GDP PER CAPITA

SOCIAL SUPPORT

HEALTHY LIFE EXPECTANCY AT BIRTH

FREEDOM TO MAKE LIFE CHOICES

PERCEPTION OF CORRUPTION

POSITIVE EMOTIONS

AVERAGE YEARS OF SCHOOL

SLIDE 21 - SUMMARY

- The results of our analyses show the following:
- The happiest European countries are Denmark and Finland
- In the rest of the world the happiest countries are Canada, Israel and New Zealand
- 7 Variable Enhance the Performance of our Predictive Model

Outlook: Dive Deeper



EXPAND INSIGHTS...

DENMARK, FINLAND, EUROPE, ... THE WEST ...
got it “right” ✓

BLUEPRINT... uncover more factors... better
predictors...

FURTHER UNDERSTANDING

BIAS ... western ideals, phrasing

HAPPINESS ... correct metric or not?

- Expand current research:
- Denmark, Finland, western countries according to our findings here have gotten it right, so to speak.
- Let's dig further into indices and uncover additional factors that can predict and make a better model.
- A blueprint or template can be made for other countries to follow.
- What we've examined has only scratched the surface
- Our Findings warrant also further understand about the nature and design

Outlook: Dive Deeper



EXPAND INSIGHTS...

DENMARK, FINLAND, EUROPE, ... THE WEST ...
got it “right” ✓

BLUEPRINT... uncover more factors... better
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FURTHER UNDERSTANDING

BIAS ... western ideals, phrasing

HAPPINESS ... correct metric or not?

SLIDE 22 – OUTLOOK (2/2)

- Inherent flaws due to bias do our western ideals of ranking translate into every culture,
- Perhaps happiness is not the end all be all? Or the correct metric?
Is happiness too fleeting momentary and hedonistic?
- Perhaps a clearer more precise definition of happiness is in order: A differentiation between a life filled with fleeting momentary hedonistic pleasures and one marked by an abiding purpose and deep sense of fulfillment.
- So those a few things we can ponder



THANKS FOR YOUR ATTENTION!



We thank you again for your attention.

See you at the Q&A.