ĐẠI HỌC
BÁCH KHOA HÀ NỘI
HANOI UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Analysis of Countries Happiness

ONE LOVE. ONE FUTURE.

Agenda

- Introduction
- Data Collection and Pre-processing
- Exploratory Data Analysis and Visualization
- Conclusion

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Introduction

Introduction

- Rapid development of global economy: global Gross Domestic Product (GDP) has more than tripled since 1990 [1].
- Economic growth does not always guarantee well-being: one in five adults in the US had received mental health treatment in 2019 [2].
- Alternative measurement: happiness score by World Happiness Report.
- Which socioeconomic factors contribute to happiness?

→ Analyzing the **correlation** of **countries happiness scores** with **socioeconomic factors**.

Methodology

- **Data Collection and Preprocessing:** gather data from multiple sources and transform to high quality single database.
- **Exploratory Data Analysis:** summarize and understand data.
- **Data Visualization:** understand and communicate insights from data through visual representation.

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Data Collection and Pre-processing

Countries Happiness Score

- Response variable.
- Annual happiness report provided by World Happiness Report [3]-[5].
- Scale from 0 to 10, with 10 is the highest score.
- Averaged of 2017-2019 period.

Countries Socioeconomic Factors

- Availability challenge.
- Fourteen explanatory variables.
- Public data from The World Bank, United Nations Development Programme (UNDP), World Health Organization (WHO), United Nations Office on Drugs and Crime (UNOCD).

List of Socioeconomic Factors

- Population density (people per sq. km of land area) [7].
- GDP per capita (current US$) [8].
- PM2.5 air pollution, mean annual exposure ($\mu g/m^3$) [9].
- Forest area (% of land area) [10].
- Consumer price index (2010 = 100) [11].
- Mean years of schooling [12].
- Life expectancy at birth (years) [13].
- Gender Development Index (GDI) [14].
- CO_2 emissions per capita (metric tons) [15].
- Unemployment rate (% of total labor force) [16].
- Healthy life expectancy at birth (HALE) [17].
- Current health expenditure (% of GDP) [18].
- Age-standardized suicide rate (per 100,000 population) [19].
- Prison population (per 100,000 population) [20].

Data Pre-processing

- Multi-source data integration by three-letter country code ISO 3166-1 alpha-3 [6].
- Handling missing data:
  - Country with more than 10 missing values: remove.
  - Otherwise: replace with mean value of the region.

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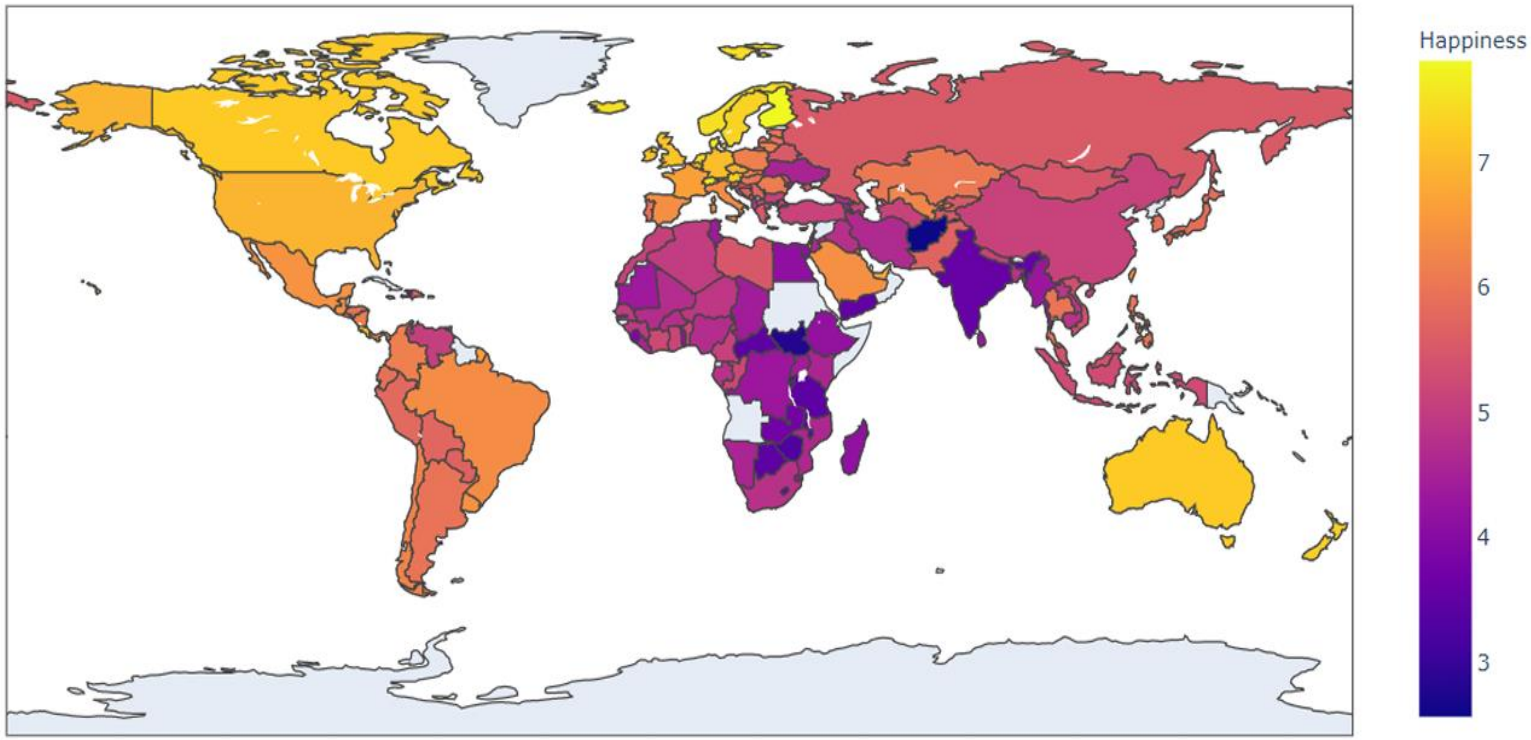
Exploratory Data Analysis and Visualization

How Happy Are People Globally?

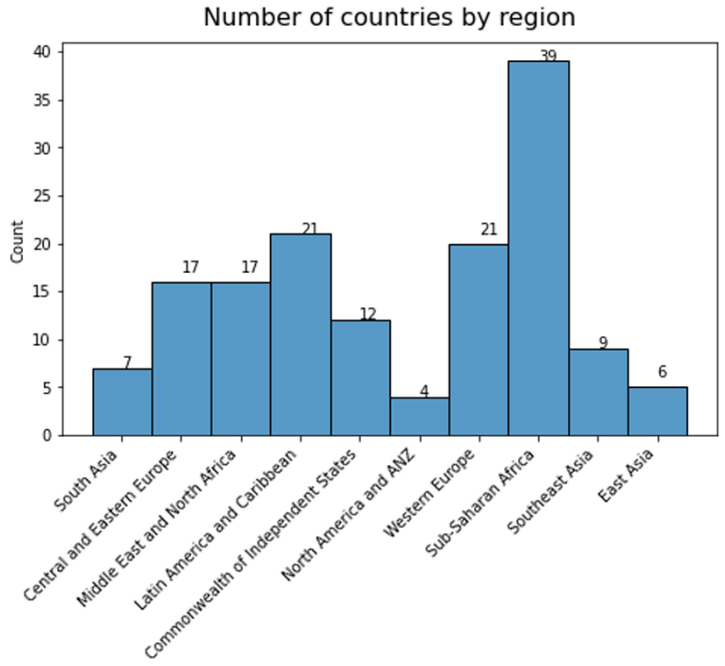
- Happier regions: Europe and North America.
- Less happy region: Africa.



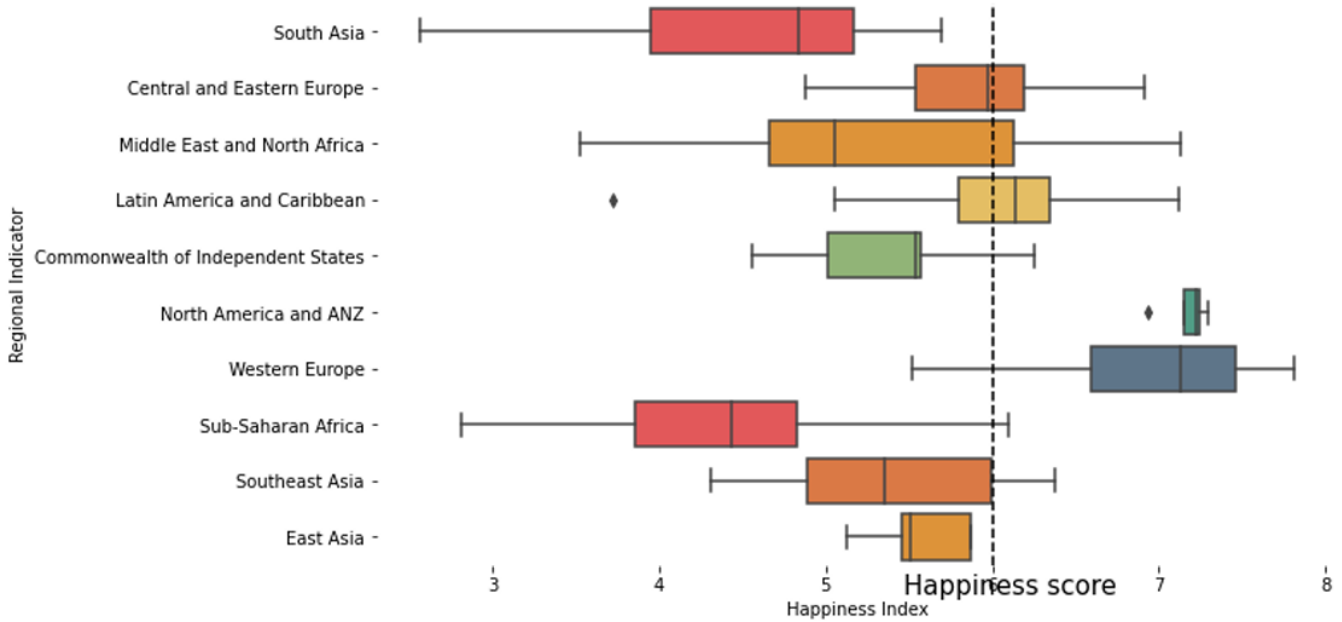
Global map of countries with happiness score.

Happiness Score By Regions

- Happy regions: Western Europe, North America and ANZ.
- Least happy region: Sub-Sahara Africa.
- Central and Eastern Europe: average happiness score.



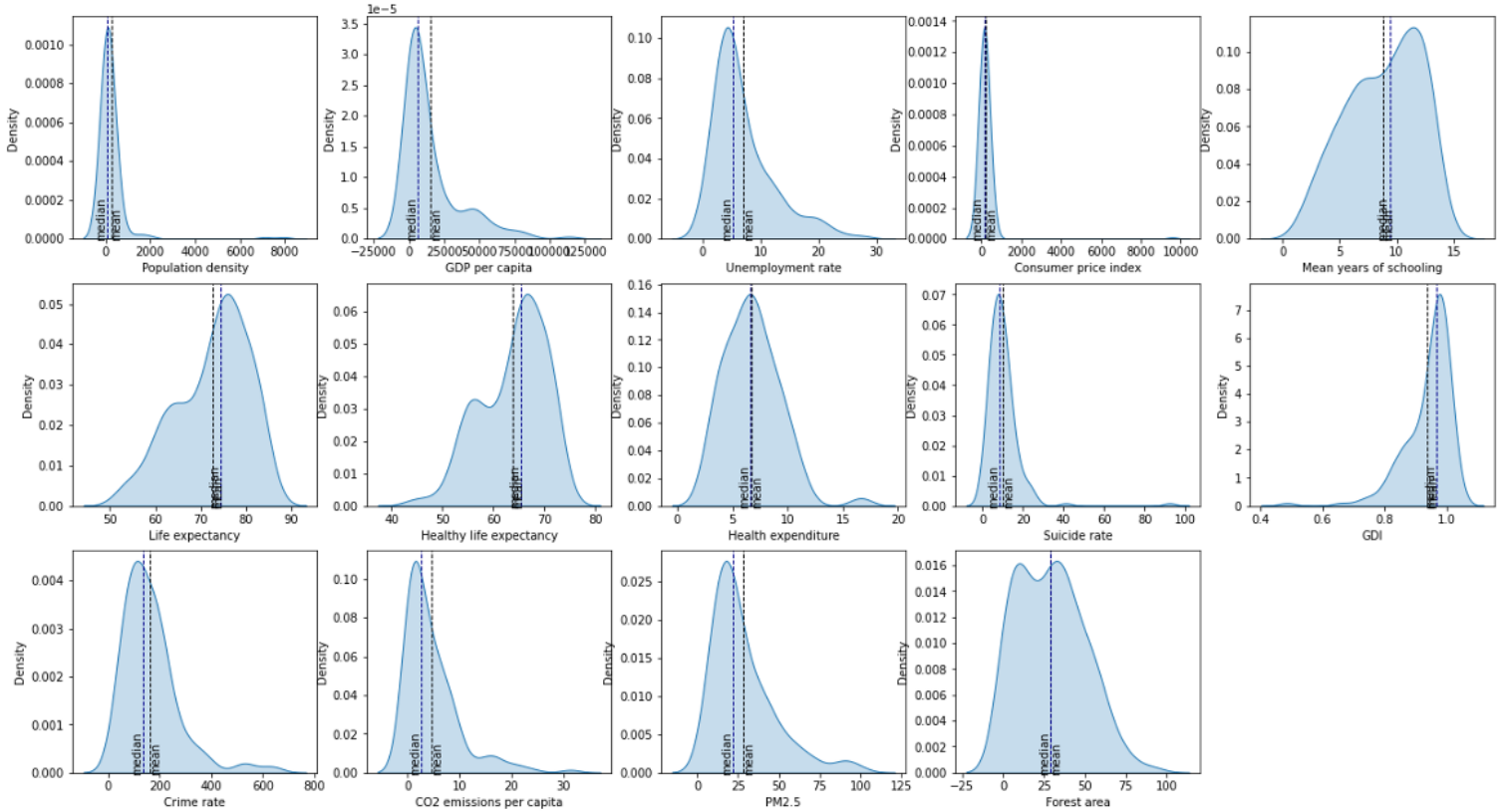
Bar chart for number of countries by region



Box plot of happiness score by regions. Dash line indicated average value.

Socioeconomic Variables Statistics

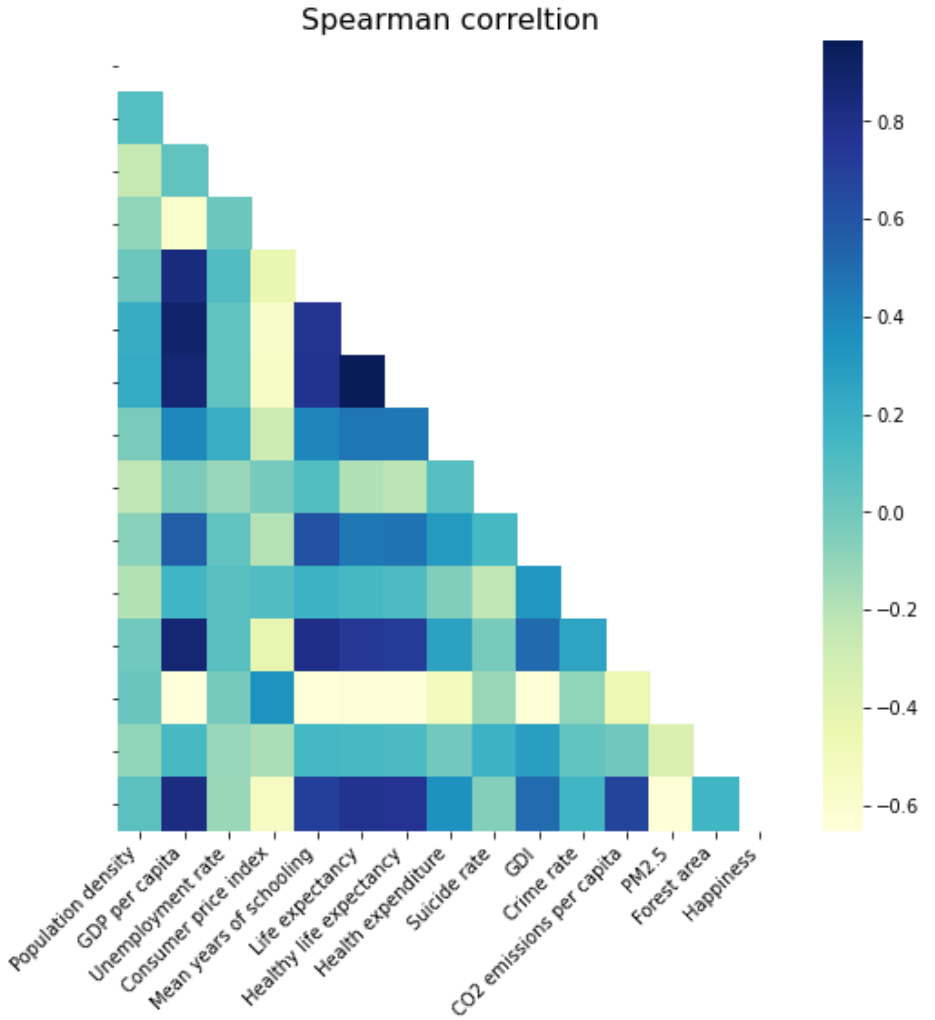
- Density plot of socioeconomic variables.
- Approximately follow normal distribution.
- Variables with outliers: population density, consumer price index, suicide rate.



Density plot of socioeconomic variables.

Correlation of Happiness Score with Socioeconomic Factors

- Happiness score is:
  - **Positively correlated** with: GDP per capita, Mean years of schooling, Life expectancy, Healthy life expectancy, CO2 emissions per capita, and GDI.
  - **Negatively correlated** with: Consumer price index and PM 2.5.
  - **Uncorrelated** with: population density, unemployment rate, health expenditure, suicide rate, crime rate, and forest area.

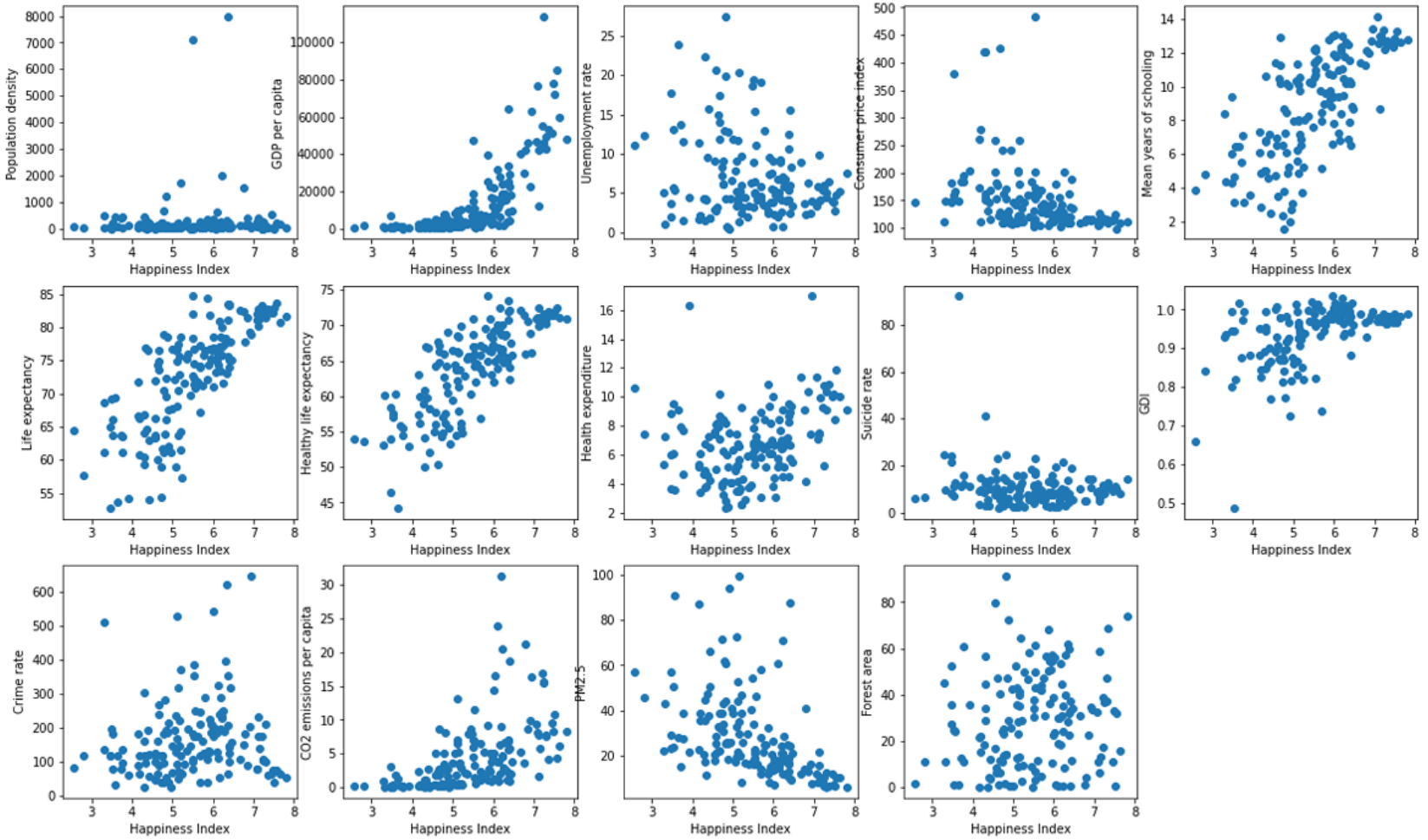


Heatmap visualization of spearman correlation between variables.

⚠ Correlation does not imply causation!

Scatter Plots of Happiness Score with Socioeconomic Factors

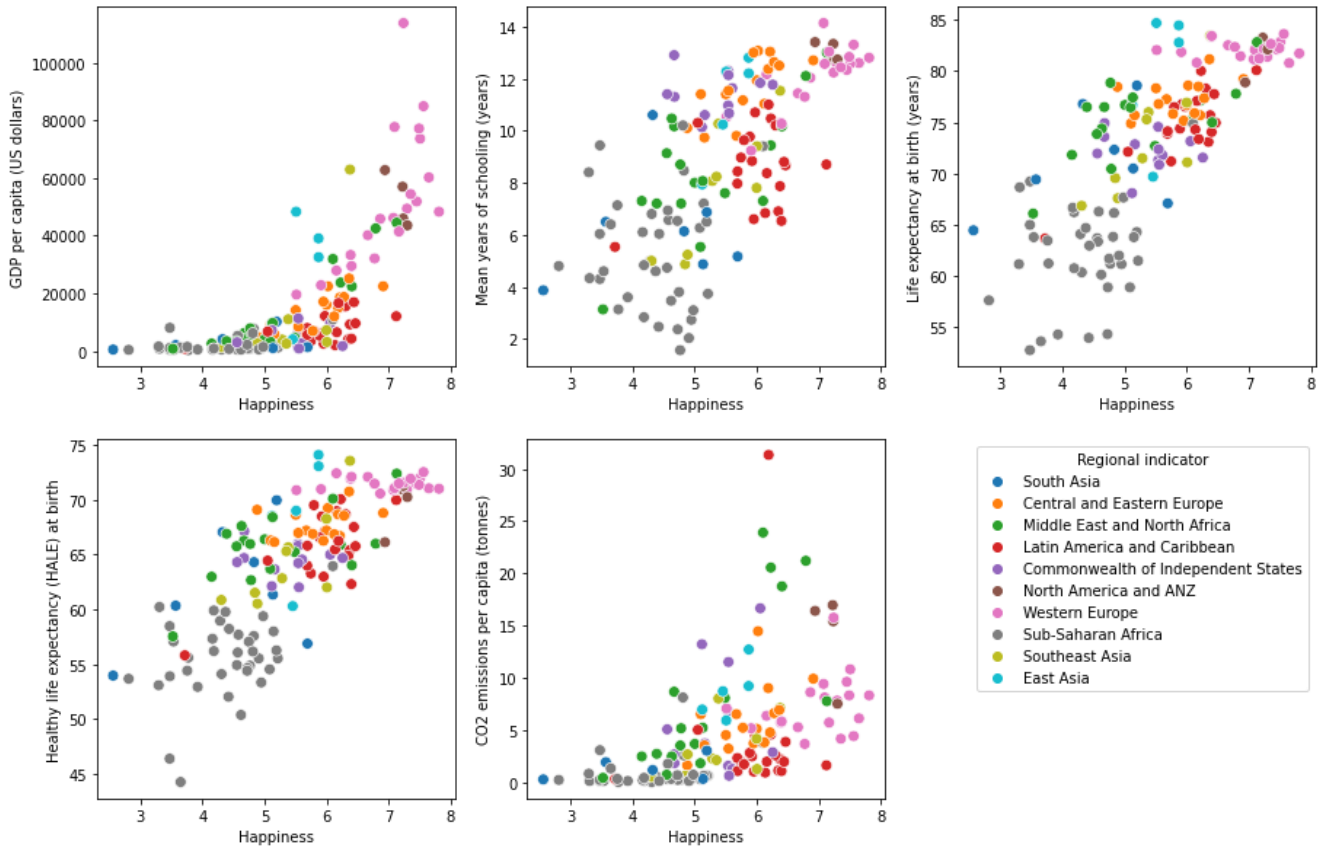
- More details of happiness score aforementioned correlations:
  - **Linear relationship**, e.g. life expectancy and mean years of schooling.
  - **Exponential relationship**, e.g. GDP per capita.



Scatter plots of happiness score with socioeconomic factors.

Scatter Plots of Happiness Score with Socioeconomic Factors

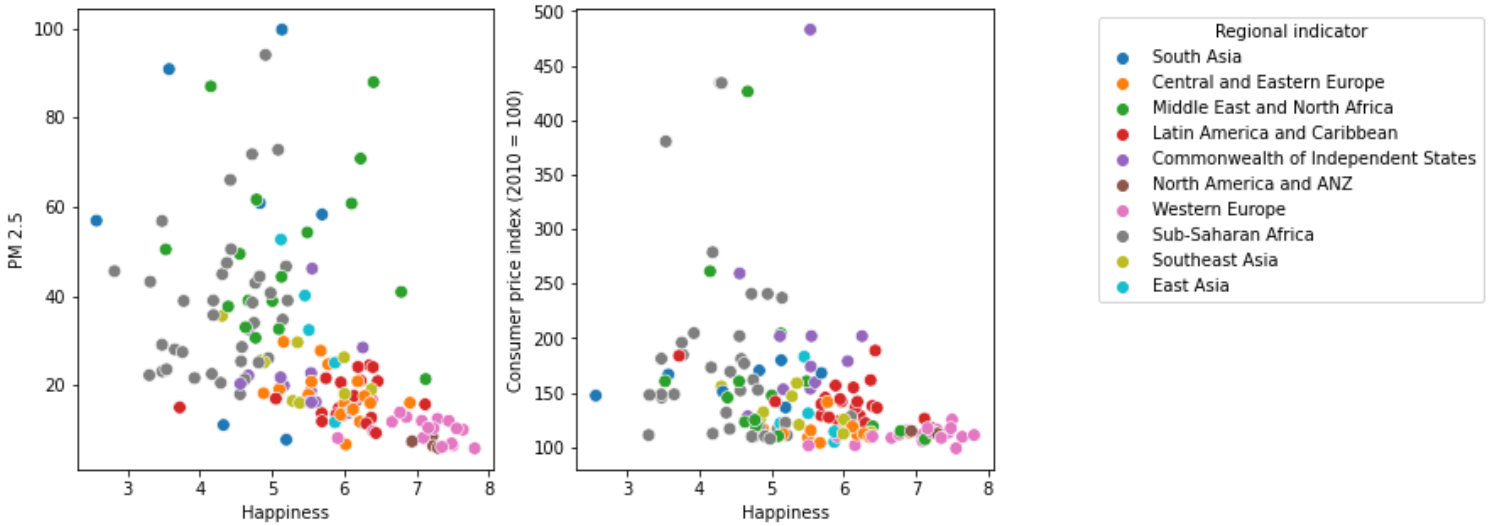
- Scatter plots of correlated variables with happiness score, grouped by region.
- Countries in the same region forms a cluster, e.g. Western Europe.



Scatter plots of happiness score with positively correlated variables by region.

Scatter Plots of Happiness Score with Socioeconomic Factors

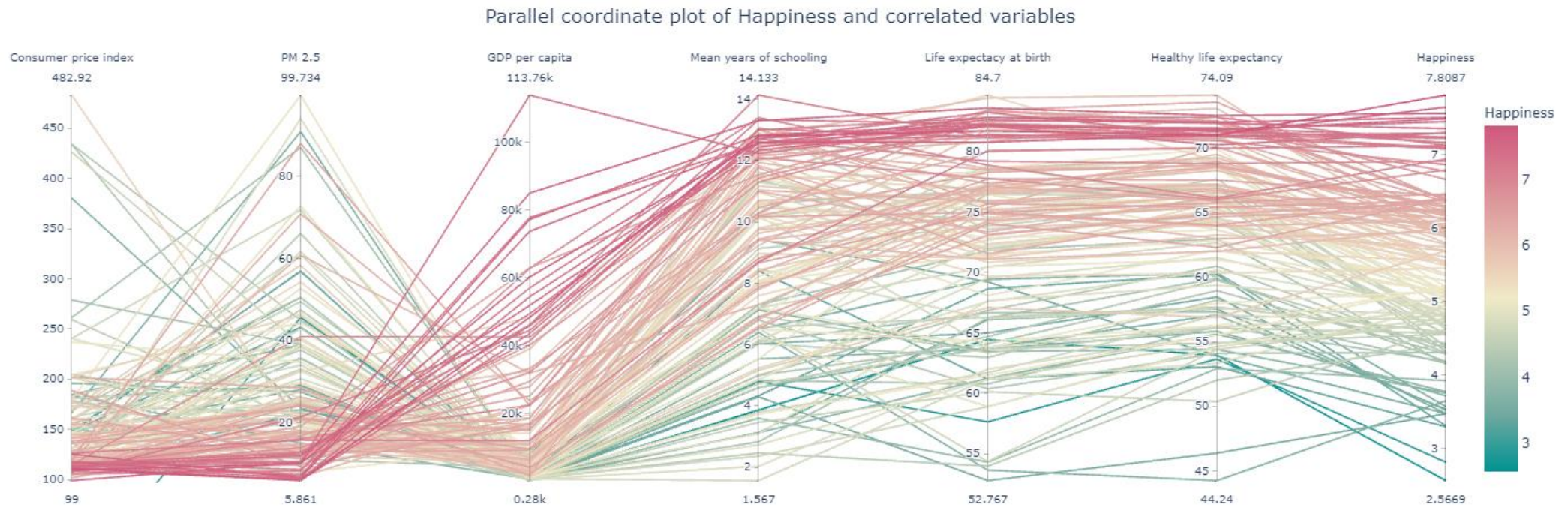
- Scatter plots of correlated variables with happiness score, grouped by region.
- Countries in the same region forms a cluster, e.g. Western Europe.



Scatter plots of happiness score with negatively correlated variables by region.

Characteristics of Happy Country

- A happy country has:
  - Low living inflation (low consumer price index) and good air quality (low PM 2.5).
  - Above-averaged GDP per capita.
  - Good education (high mean years of schooling) and health care system (high life expectancy at birth and healthy life expectancy).



Parallel coordinate plot of happiness score and correlated variables.

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Conclusion

Conclusion

- Analysis of correlation of countries happiness score with socioeconomic factors.
- Factors correlated with happiness score:
  - Positive correlation: GDP per capita, Mean years of schooling, Life expectancy, Healthy life expectancy, CO2 emissions per capita, and GDI.
  - Negative correlation: Consumer price index and PM 2.5.

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