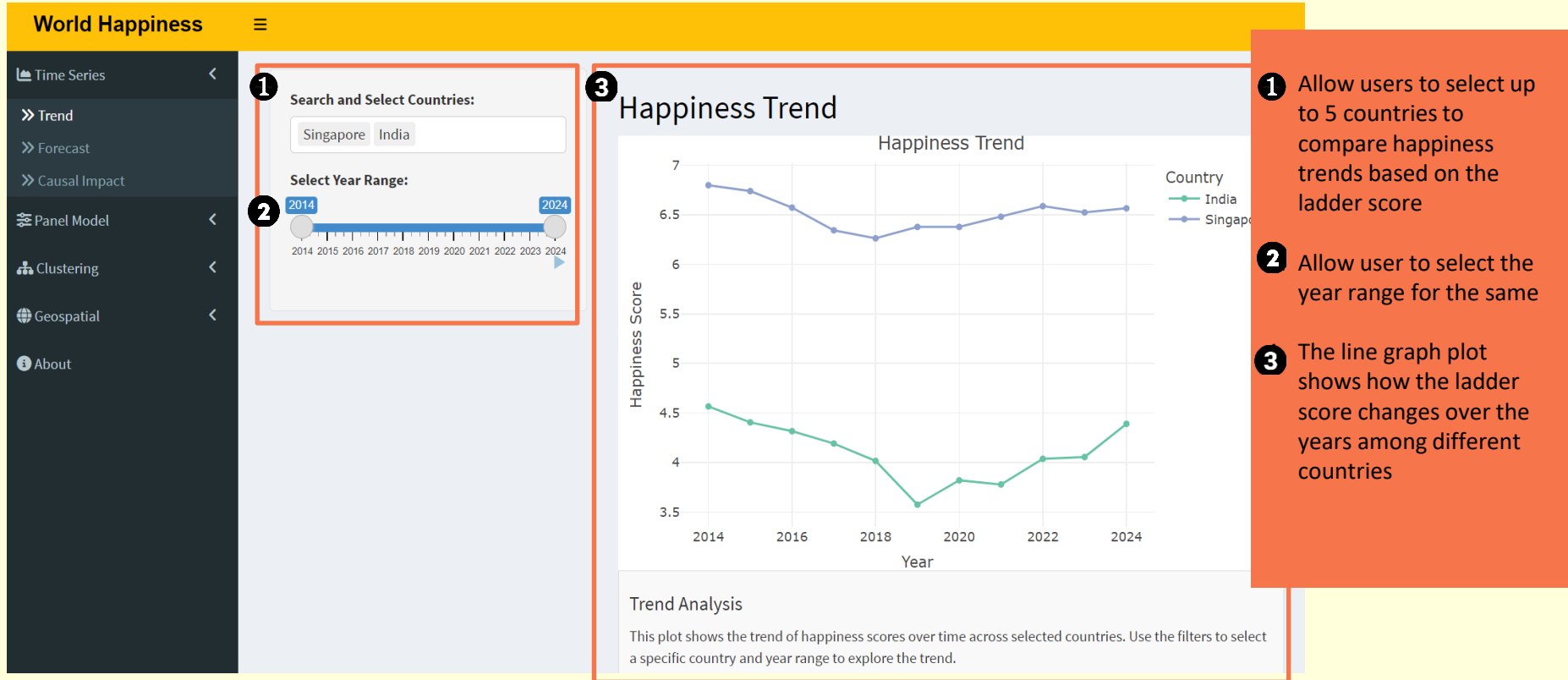


World Happiness Visualization

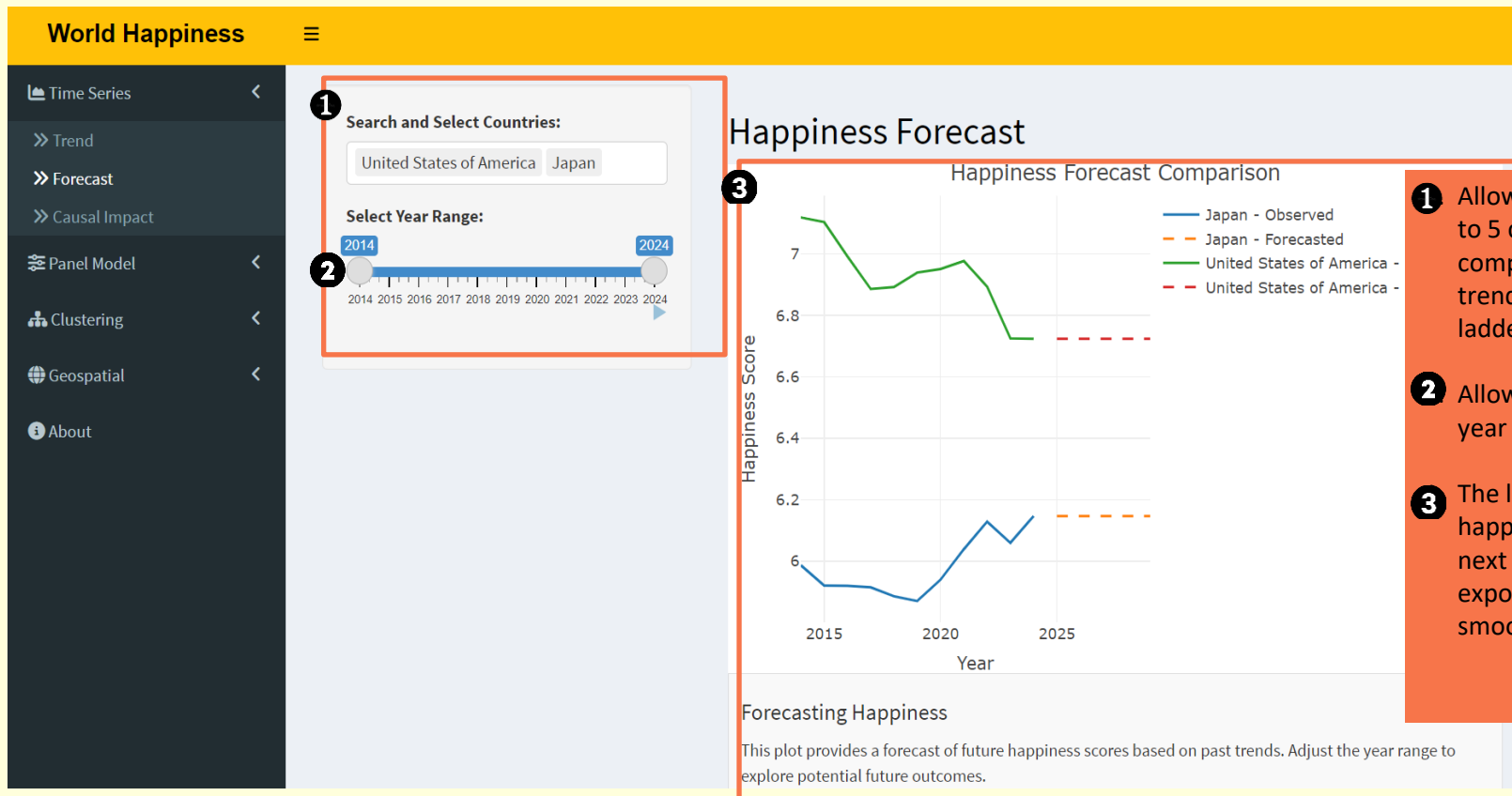
User Guide for Group 14



TIME SERIES: HAPPINESS TREND



TIME SERIES: HAPPINESS FORECAST



- 1** Allow users to select up to 5 countries to compare happiness trends based on the ladder score
- 2** Allow user to select the year range for the same
- 3** The line graph plots the happiness forecast for next 5 years using exponential smoothing.

TIME SERIES: COVID'19 HAPPINESS LEVELS

World Happiness

Time Series

>> Trend

>> Forecast

>> Causal Impact

Panel Model

Clustering

Geospatial

About

Search and Select Countries:

Singapore Japan

Select Year Range:

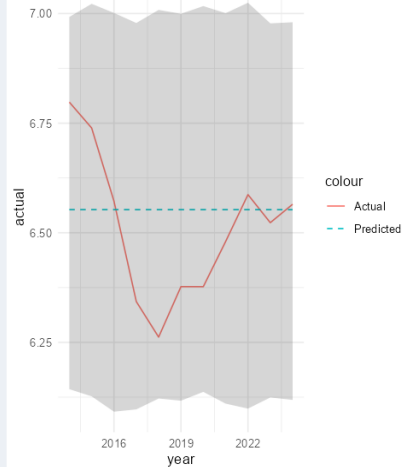
2014

2024

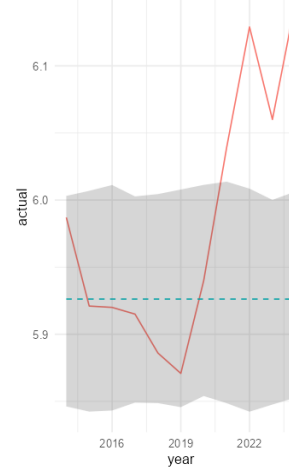
2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024

Causal Impact Analysis

Causal Impact - Singapore



Causal Impact - Japan



Causal Impact Analysis

This plot shows the causal impact of events (e.g., COVID-19, economic crises) on happiness scores. Use this to understand how external factors may have influenced the happiness trends.

- 1 Allow users to select up to 5 countries to compare happiness trends based on the ladder score
- 2 Allow user to select the year range for the same
- 3 Casual Impact Plot compares countries and their happiness level before and after covid.

PANEL MODEL: FEATURE IMPORTANCE

World Happiness



Time Series <

Panel Model <

>> Feature Importance

>> Happiness Trend

>> Panel Data Insights

Clustering <

Geospatial <

About

Feature Importance

1

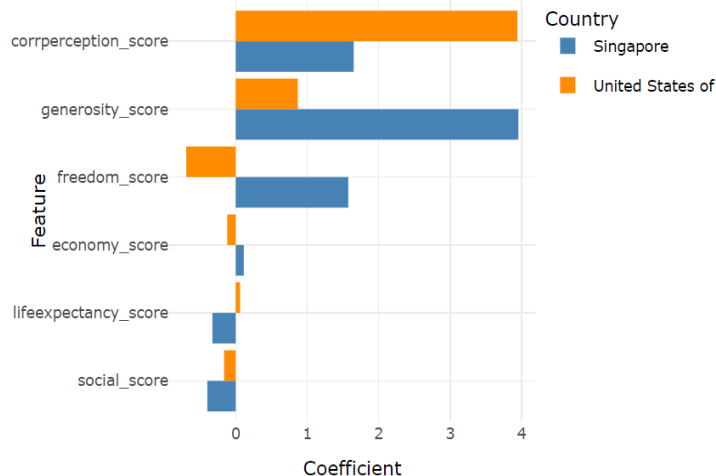
Select Up to 2 Countries:

Singapore

United States of America

2

Feature Importance (Fixed Effects Model)



1

This allows users to select 2 countries from the list

2

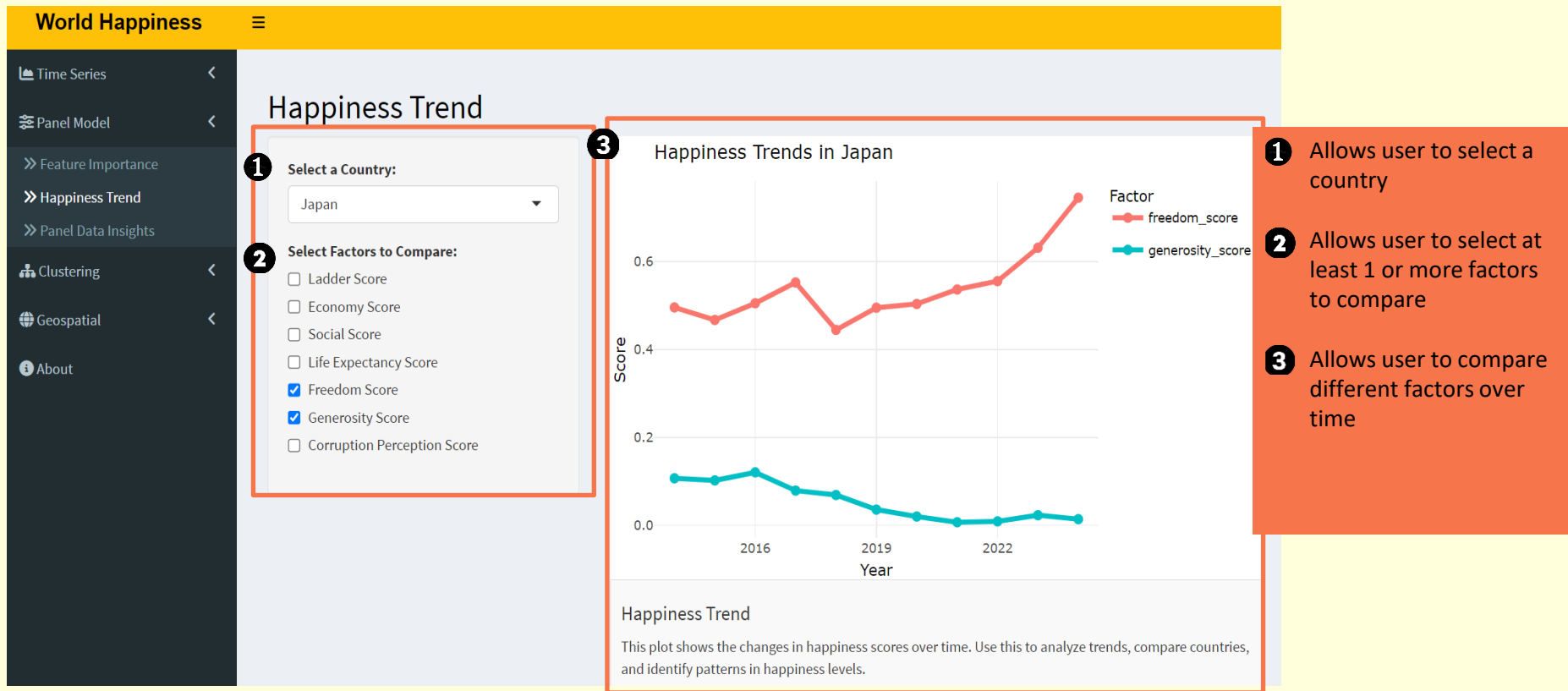
The feature importance comparison plot, shows how the 2 countries vary in their scores based on the different factors.

[Note : this helps understand how the factors in developing countries differ from developed countries]

Feature Importance

This plot highlights the most significant factors influencing happiness scores. Larger bars indicate greater importance in predicting happiness levels.

PANEL MODEL: HAPPINESS TREND (using factor)



PANEL MODEL: DATA TABLE

World Happiness

- Time Series
- Panel Model
 - Feature Importance
 - Happiness Trend
 - Panel Data Insights
- Clustering
- Geospatial
- About

Panel Data Insights

1 Do you want to save the data?
[Download Data as CSV](#)

Panel Data Table

Top Improvement

What-If Analysis

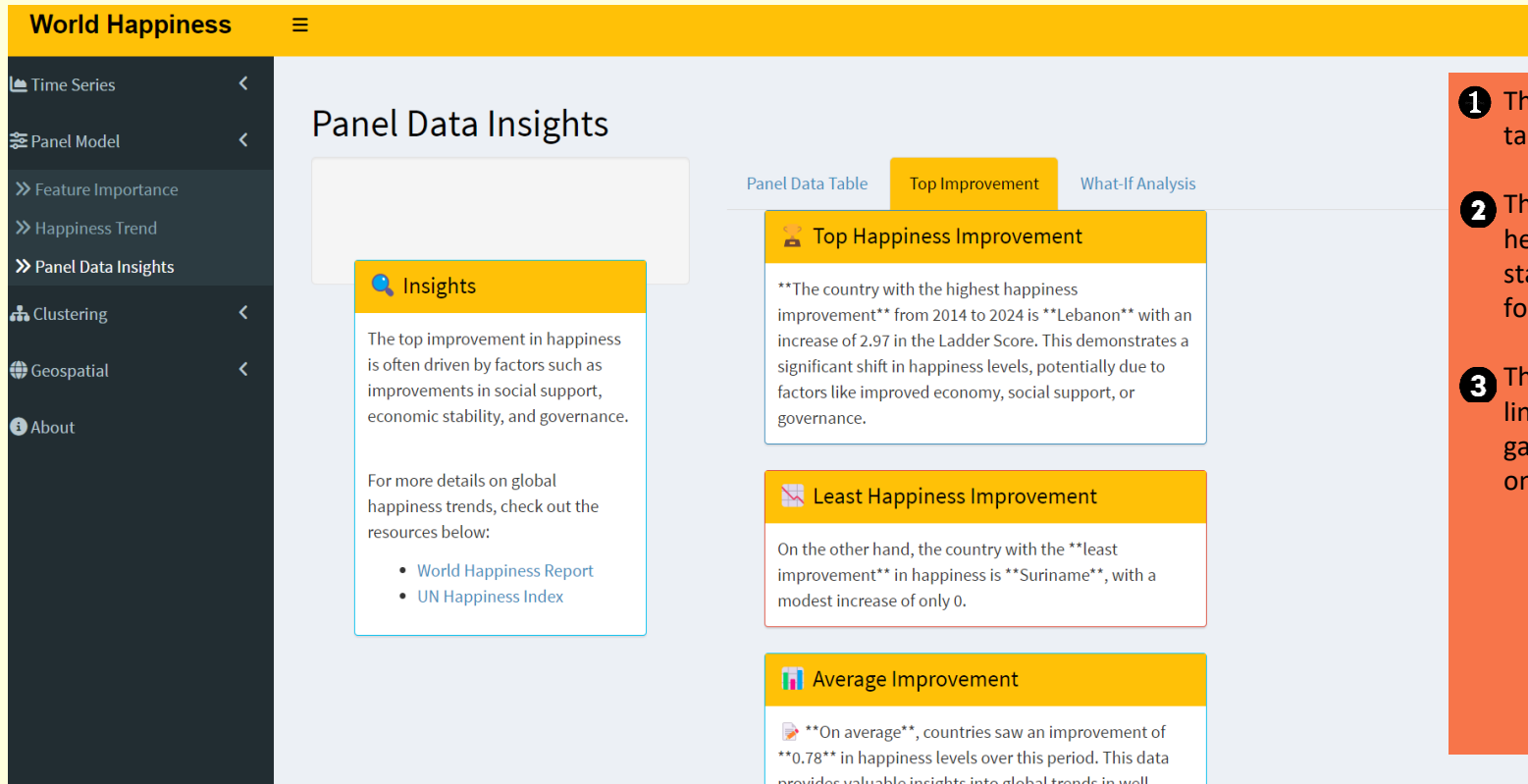
Show 10 entries

Search: saudi

year	country	ladder_score	economy_score	social_score	lifeexp
2014	Saudi Arabia	6.411	1.39541	1.08393	
2015	Saudi Arabia	6.379	1.48953	0.84829	
2016	Saudi Arabia	6.344	1.53062	1.28668	
2017	Saudi Arabia	6.371	1.379	1.331	
2018	Saudi Arabia	6.375	1.403	1.357	
2019	Saudi Arabia	6.4065	1.33433	1.30995	
2020	Saudi Arabia	6.494	1.435	0.964	

1 This sub tab under panel data insights allows user to filter the data table based on country of choice and save that data as a csv file

PANEL MODEL: DATA INSIGHTS



- 1 This is the insights sub tab.
- 2 There is no interactivity here, but important statistics are summarized for users.
- 3 There are also external links if the user wishes to gain more information on happiness data/index

PANEL MODEL: WHAT IF ANALYSIS SIMULATOR

World Happiness

Time Series

Panel Model

Feature Importance

Happiness Trend

Panel Data Insights

Clustering

Geospatial

About

Panel Data Insights

1 Select a Country:

Japan

2 Select year:

2018

3 Predicted Happiness Score:

Selected Country: Japan
Selected Year: 2018
Existing Happiness Score: 5.89
New Predicted Happiness Score: 7.93
Change: 2.05

Panel Data Table

Top Improvement

What-If Analysis

4 What-If Analysis: Adjust Factors

Economy Score

0.31

Social Support Score

0.14

Life Expectancy Score

0.39

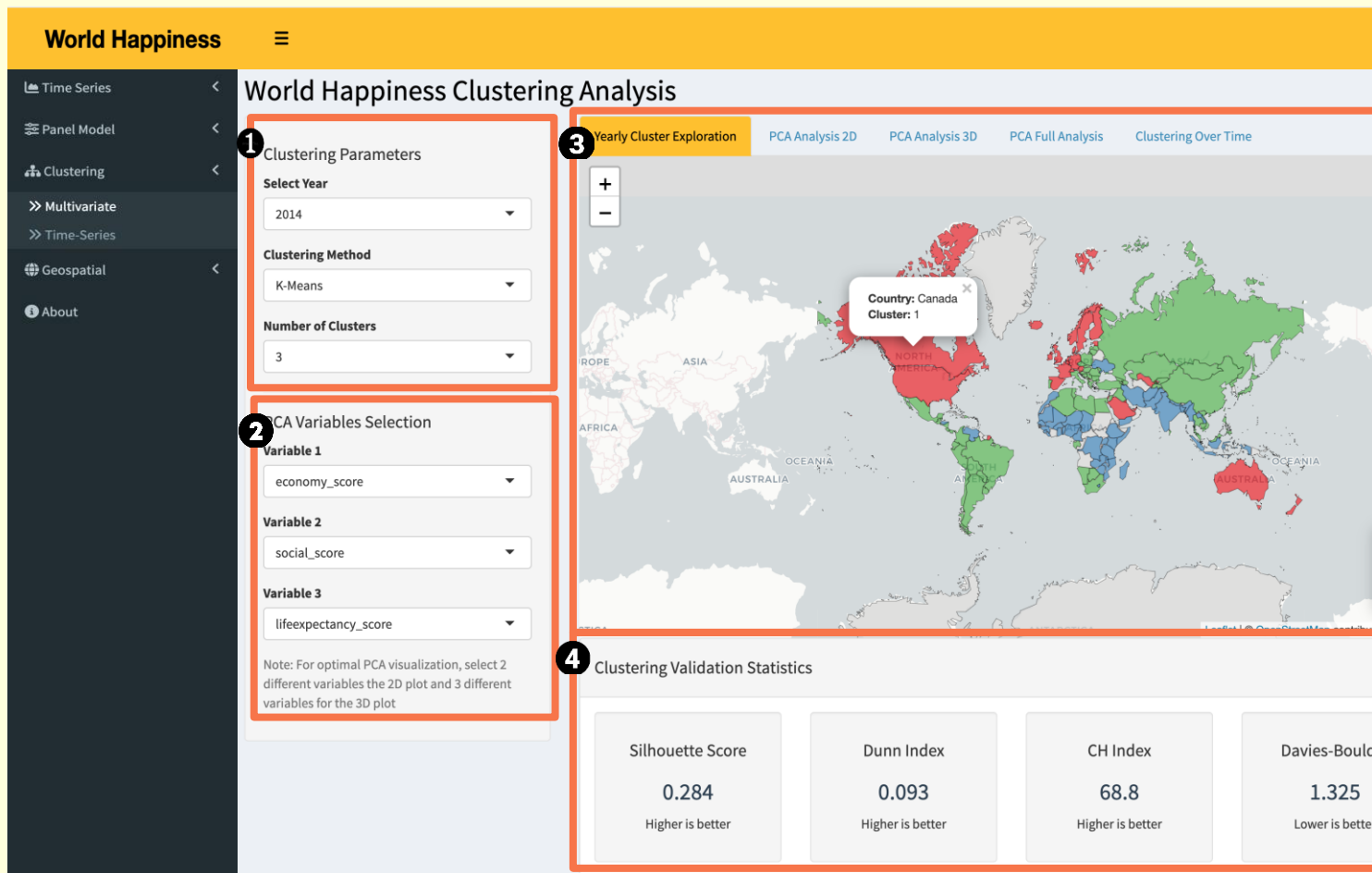
Freedom Score

0.65

This sub tab is What-if analysis which is kind of a simulator to understand how happiness factors affect the score

- 1 User can select a country of choice
- 2 User can select a year of choice
- 3 User can update and change the value of the different factors
- 4 Dynamic text is rendered which allows user to see the change in happiness score.

CLUSTERING: YEARLY CLUSTER EXPLORATION



1 Allow for the selection of the "Year" [2014-2024]

- Allow for the selection of "Clustering Method" [K-means, Hierarchical]

- Allow for the selection of "Number of Clusters" [1-8]

2 All for selection of Variables for PCA Analysis [economy_score, social_score, lifeexpectancy_score, freedom_score, generosity_score, corrrperception_score]

3 Plot showing the Geographical Map with different colors for different clusters

4 Clustering Validation Statistics

CLUSTERING: PCA ANALYSIS 2D

World Happiness



Time Series

Panel Model

Clustering

>> Multivariate

>> Time-Series

Geospatial

About

World Happiness Clustering Analysis

Clustering Parameters

Select Year

2014

Clustering Method

K-Means

Number of Clusters

3

PCA Variables Selection

Variable 1

economy_score

Variable 2

social_score

Variable 3

lifeexpectancy_score

Note: For optimal PCA visualization, select 2 different variables the 2D plot and 3 different variables for the 3D plot

1

Yearly Cluster Exploration

PCA Analysis 2D

PCA Analysis 3D

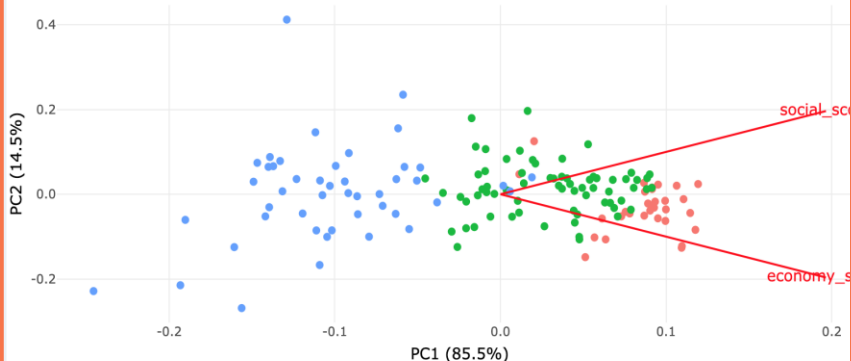
PCA Full Analysis

Clustering Over Time

What is PCA (Principal Component Analysis)?

PCA is a technique that reduces the number of variables while preserving most of the important information (variance) in the data. It creates variables, called Principal Components, which are combinations of the original variables. The first few components usually capture most of the variation. PCA is used here to project the clustered data into a 2D space, making it easier to visualize how well-separated the clusters are.

Think of PCA as finding the best viewing angle to observe patterns in complex data.



2

Loadings Matrix

Interpretation

PC1 (85.5% variance explained)

- positively driven by **economy_score**
- positively driven by **social_score**

PC2 (14.5% variance explained)

- positively driven by **social_score**
- negatively driven by **economy_score**

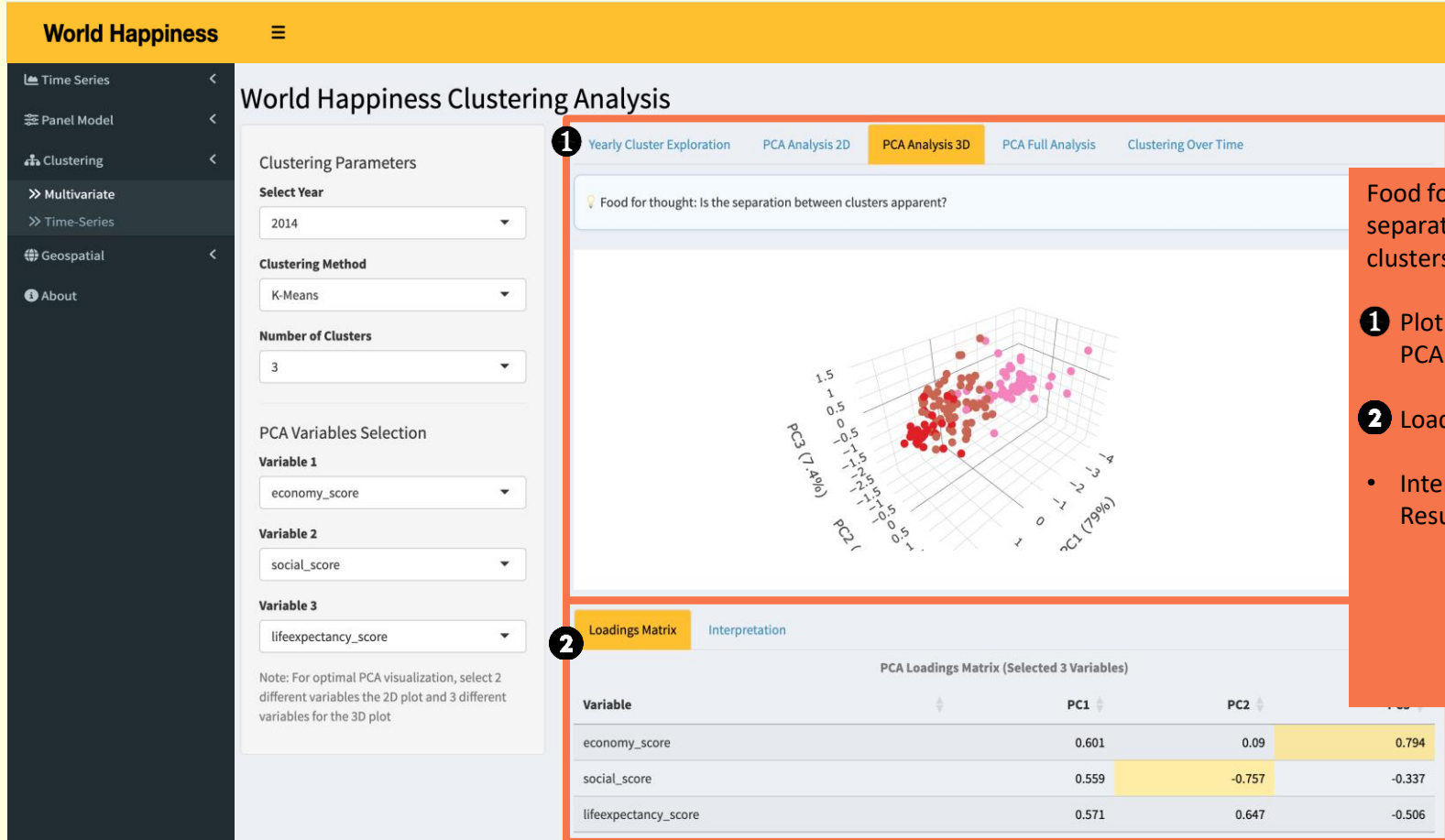
1 Explanation of PCA Analysis

- Plot showing the 2D PCA Analysis

2 Loading Matrix

- Interpretation of results

CLUSTERING: PCA ANALYSIS 3D



Food for Thought – Is the separation between clusters approved?

1 Plot showing the 3D PCA Analysis

2 Loading Matrix

- Interpretation of Results

CLUSTERING: PCA FULL ANALYSIS

World Happiness

Time Series

Panel Model

Clustering

Multivariate

Time-Series

Geospatial

About

World Happiness Clustering Analysis

1

Yearly Cluster Exploration

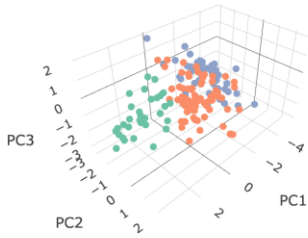
PCA Analysis 2D

PCA Analysis 3D

PCA Full Analysis

Clustering Over Time

This PCA plot uses all clustering variables for analysis



2

Loadings Matrix

Interpretation

PCA Loadings Matrix (All Variables)

Variable	PC1	PC2	PC3
economy_score	0.513	0.261	-0.05
social_score	0.471	0.223	0.35
lifeexpectancy_score	0.505	0.067	-0.24
freedom_score	0.365	-0.252	0.568
generosity_score	0.07	-0.832	0.174

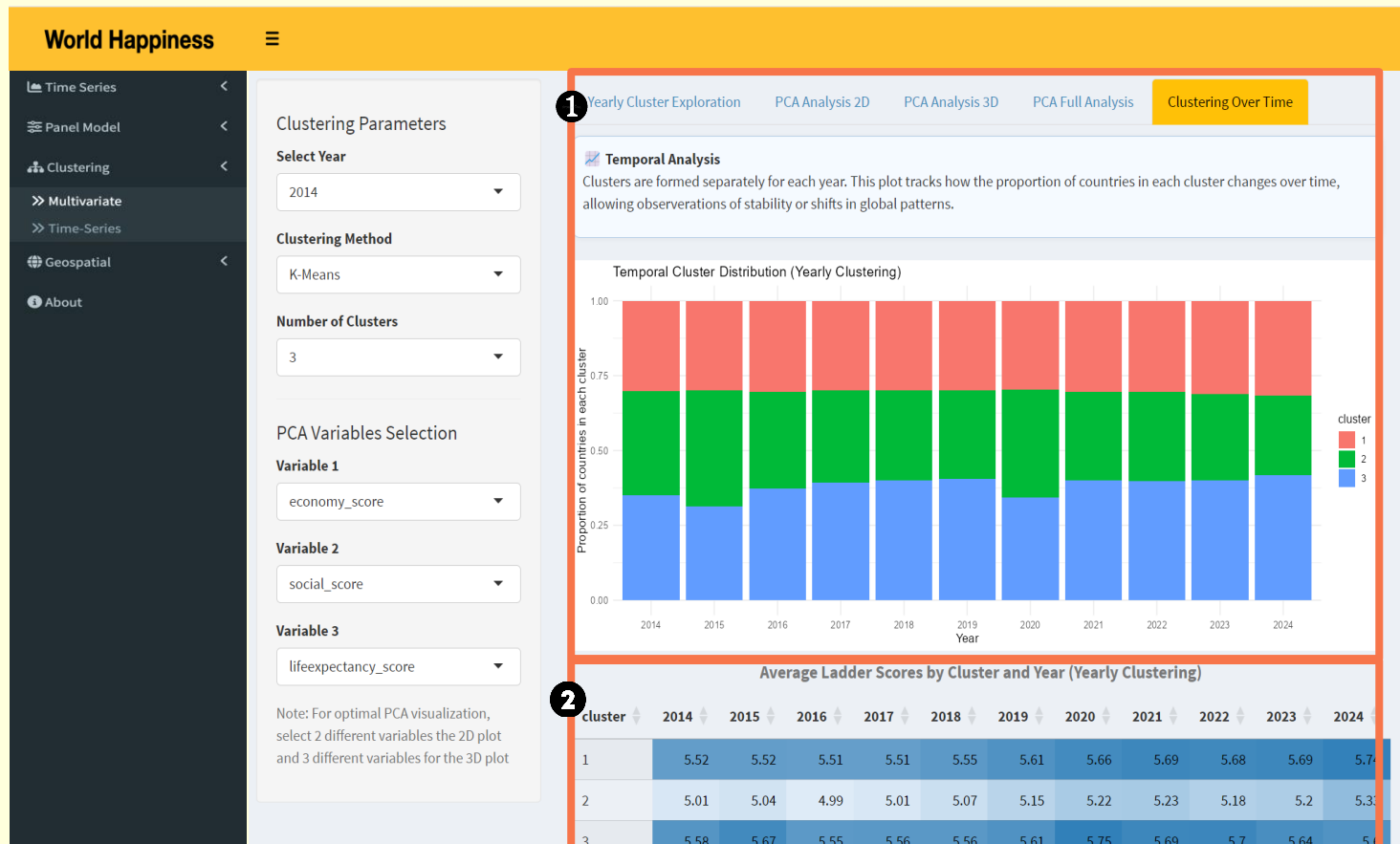
Note: For optimal PCA visualization, select 2 different variables for the 2D plot and 3 different variables for the 3D plot

1 Plot showing the 3D PCA Analysis

2 Loading Matrix

- Interpretation of Results

CLUSTERING: CLUSTERING OVER TIME



1 100% Stacked Bar Plot showing the Temporal Cluster Distribution

2 Clustering Statistics by Year (ladder score)

CLUSTERING: OPTIMAL CLUSTERS

World Happiness

Time Series

Panel Model

Clustering

>> Multivariate

>> Time-Series

Geospatial

About

- 1.Feature based clustering
- 2.DTW based clustering
- 3.Shape clustering

Clustering Method:

Feature-based Clustering

Number of Clusters:



Select Features:

- ☒ Mean
- ☐ Variance
- ☒ Trend
- ☐ Autocorrelation

Run Clustering

Method Info:

Feature-based clustering summarizes each time series into statistical features such as mean, variance, trend, and autocorrelation, then applies k-means clustering on these features.

Series Clustering

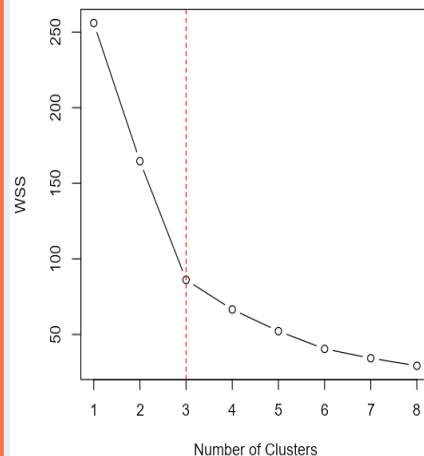
Optimal Clusters

Cluster Results

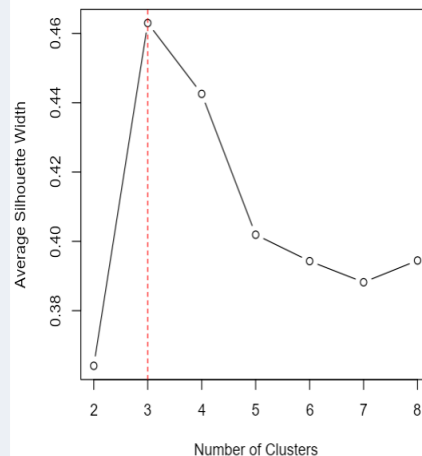
Geographical Distribution

Statistical Analysis

Elbow Method



Silhouette Plot



1 Allow for the selection of the Clustering Method – “Feature-based clustering, DTW-based clustering, Shape clustering”

- Allow for the selection of the no. of clusters
- Allow for the selection of the features.

2 Graph showing the clusters based on Elbow Method/ Silhouette Plot

CLUSTERING: CLUSTER RESULTS

World Happiness



Time Series

Panel Model

Clustering

Multivariate

Time-Series

Geospatial

About

World Happiness Time Series Clustering

Clustering Method:

Feature-based Clustering

Number of Clusters:



Select Features:

- ☒ Mean
- ☐ Variance
- ☒ Trend
- ☐ Autocorrelation

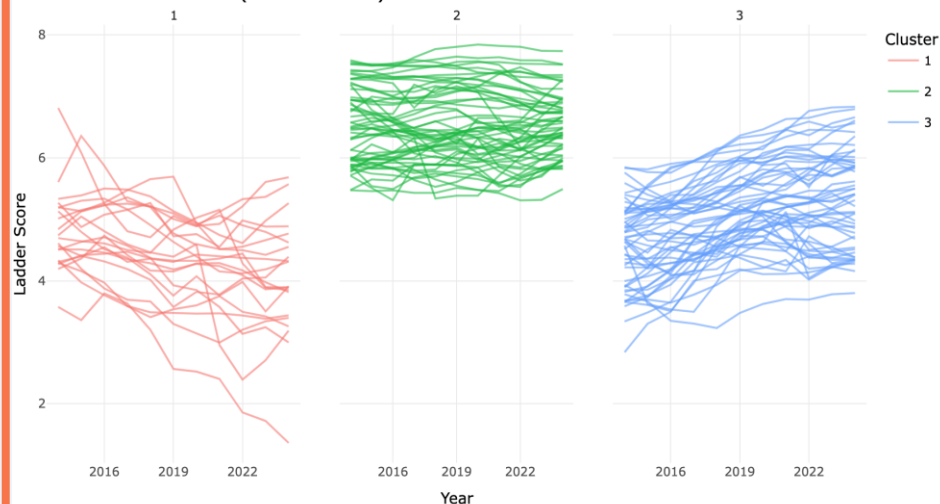
Run Clustering

Method Info:

Feature-based clustering summarizes each time series into statistical features such as mean, variance, trend, and autocorrelation, then applies k-means clustering on these features.

1 Optimal Clusters Cluster Results Geographical Distribution Statistical Analysis

Time Series Clusters (Feature-based)



1 The line graph plots the ladder score for all the years for visual comparison of the different clusters.

CLUSTERING: GEOGRAPHICAL DISTRIBUTION

World Happiness



Time Series

Panel Model

Clustering

>> Multivariate

>> Time-Series

Geospatial

About

World Happiness Time Series Clustering

Clustering Method:

Feature-based Clustering

Number of Clusters:



Select Features:

- ☒ Mean
- ☐ Variance
- ☒ Trend
- ☐ Autocorrelation

Run Clustering

Method Info:

Feature-based clustering summarizes each time series into statistical features such as mean, variance, trend, and autocorrelation, then applies k-means clustering on these features.

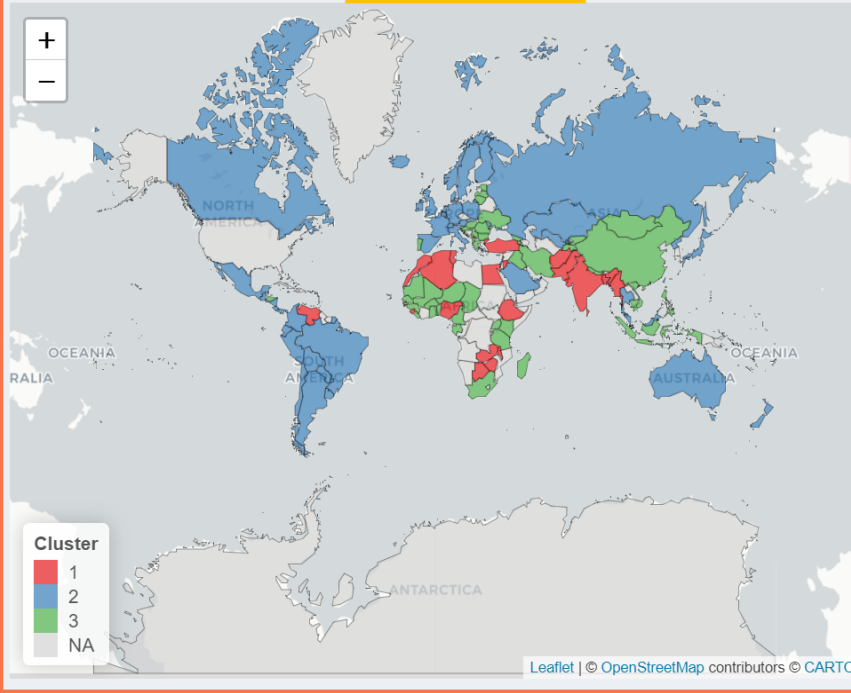
1

Optimal Clusters

Cluster Results

Geographical Distribution

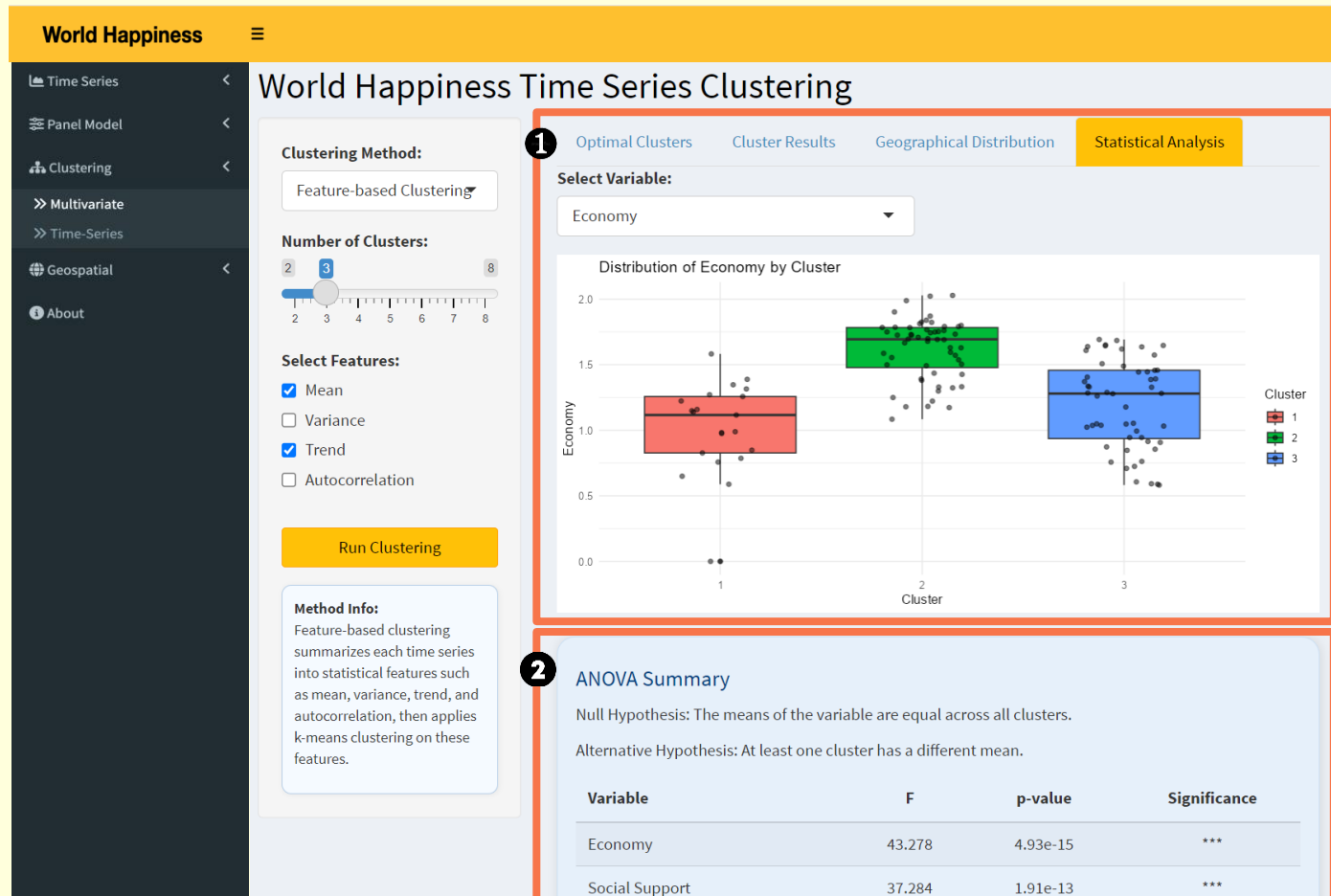
Statistical Analysis



1

Plot showing the countries by clusters based on the selection of the users

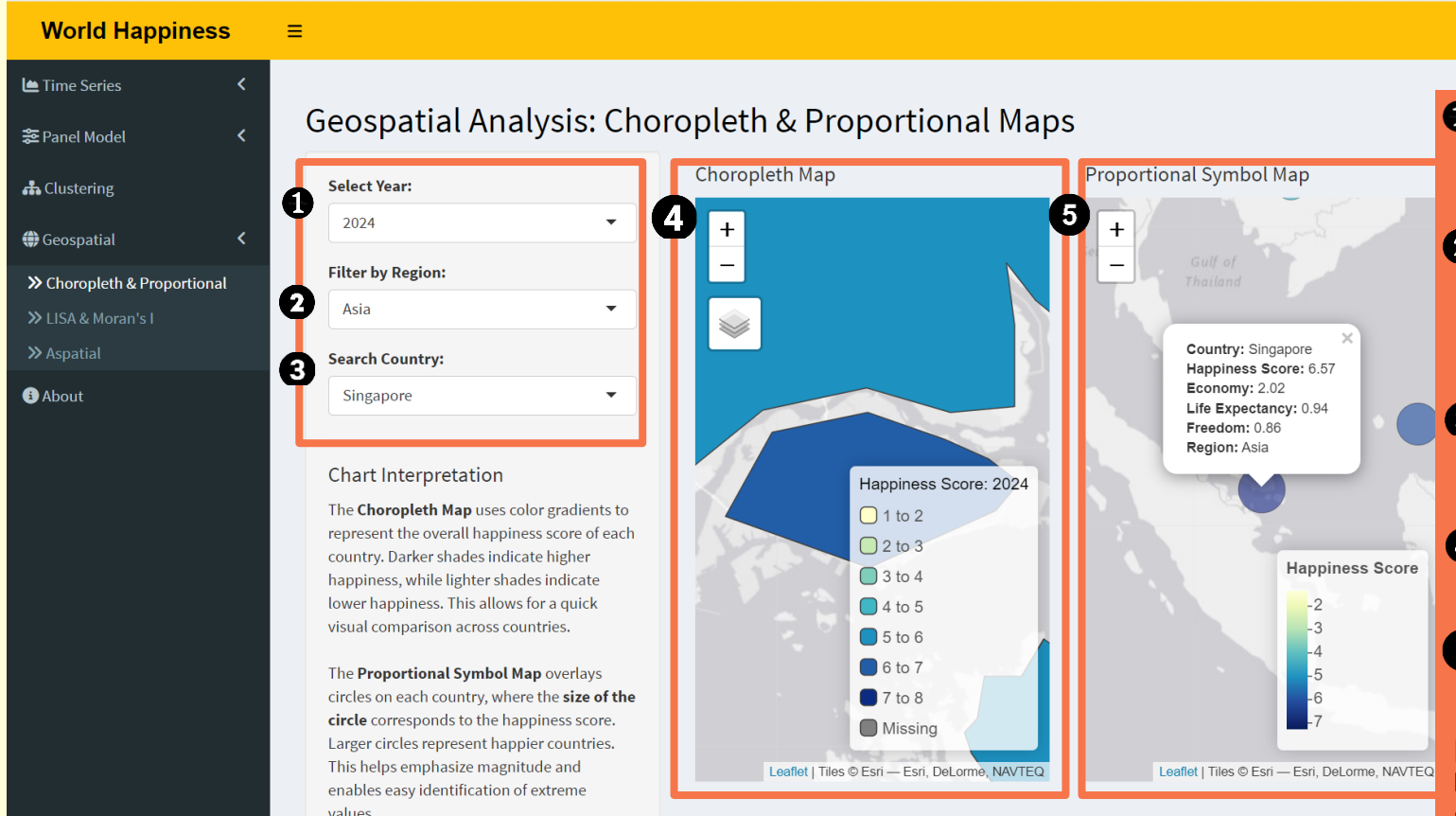
CLUSTERING: STATISTICAL ANALYSIS



1 Boxplots showing the statistics of the different clusters based on the user's selection

2 ANNOVA Test Result Summary at a glance

GEOSPATIAL ANALYSIS: CHOROPLETH & PROPORTIONAL MAPS



- 1** Allow for the selection of the “Year” [2014 to 2024]
- 2** Allow for the selection of “Region” [All, Africa, Americas, Asia, Europe, Oceania]
- 3** Allow for selection of “Country” [173 countries]
- 4** Plot showing the Choropleth Map
- 5** Plot showing the proportional symbol map

[Auto-zoom in features for both maps to allow for easy referencing]

GEOSPATIAL ANALYSIS: LISA & MORAN'S I

World Happiness



Time Series

Panel Model

Clustering

Geospatial

>> Choropleth & Proportional

>> LISA & Moran's I

>> Aspatial

About

Geospatial Analysis: LISA & Moran's I

1 Select Year:

2023

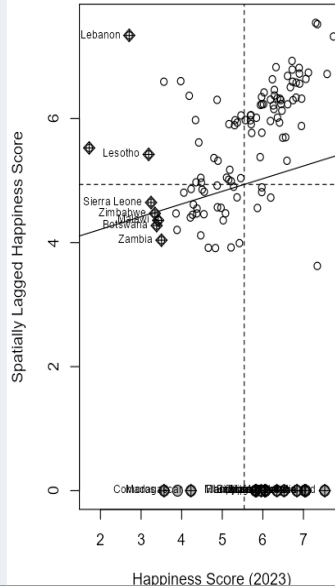
Chart Interpretation

The Moran scatterplot shows how each country's happiness score correlates with its neighbors'.

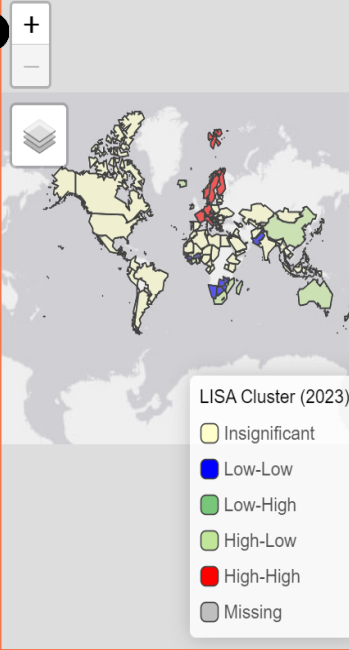
The LISA Cluster map highlights statistically significant spatial clusters:

- **High-High**: Top right quadrant - Happy countries near other happy countries
- **Low-Low**: Bottom left quadrant - Unhappy countries near unhappy neighbors
- **Low-High**: Top left quadrant - Potential outliers
- **High-Low**: Bottom right quadrant - Potential outliers
- **Insignificant**: No strong spatial pattern

2



3

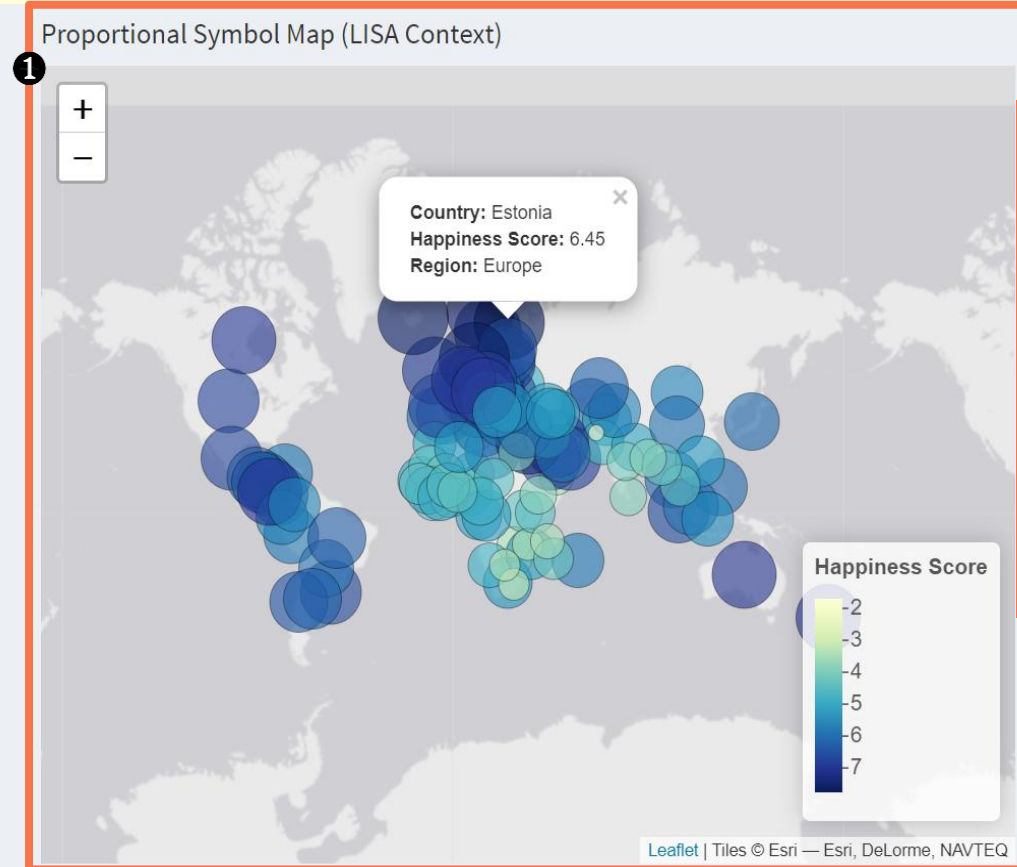


1 Allow for the selection of the "Year" [2014 to 2024]

2 Moran scatterplot – shows the spatial lag of happiness score (y axis) against country's own happiness score (x axis)

3 LISA cluster map – highlights the statistically significant spatial clusters based on local spatial autocorrelation with neighbouring nations.

GEOSPATIAL ANALYSIS: LISA & MORAN'S I



1 Proportional symbol map provides an intuitive overview of each country's happiness score using bubble size and color.

- Visually confirms patterns observed in the Moran scatterplot and LISA cluster map.

GEOSPATIAL ANALYSIS: ASPATIAL EXPLORER

World Happiness



- Time Series
- Panel Model
- Clustering
- Geospatial
 - Choropleth & Proportional
 - LISA & Moran's I
 - Aspatial
- About

Geospatial Analysis: Aspatial Explorer

1

Select Year:

2023

2

Search and Select Region(s):

Asia, Europe, Africa, Ame

Chart Interpretation

The **Left Map** provides a simple geographic overview of the selected regions without considering spatial relationships like proximity or clustering. It helps orient users geographically while remaining neutral to spatial dependence.

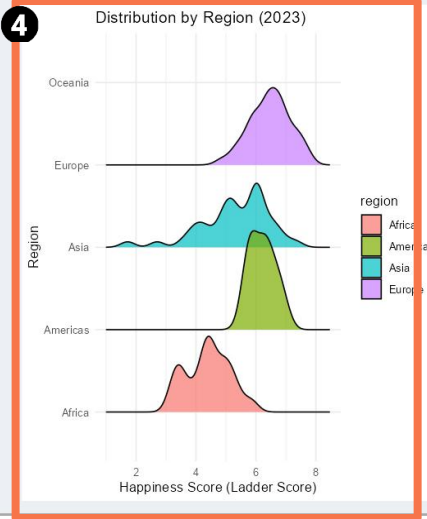
The Region-Level Ridgeline Plot Chart (top right)

compares average happiness scores across selected regions. This enables users to quickly identify which regions are generally happier or less

3



4



Happiness Score Dashboard: 2014–2024

COUNTRY	Min Score (2014–24)	Max Score (2014–24)	2024 Score	2024 vs Avg
Afghanistan	1.3640	3.7940	1.364	<div><div></div></div>
Albania	4.5860	5.4110	5.411	<div><div></div></div>

1 Allow for the selection of the “Year” [2014 to 2024]

2 Allow for multiple filtering by region (e.g.: Asia, Europe, Africa etc.) to compare and explore regional happiness trends.

3 Visualizes each country’s happiness score using bubble size and color.

4 Displays the distribution of happiness scores by region using region-wise ridgeline plot.

GEOSPATIAL ANALYSIS: ASPATIAL EXPLORER

1

The **Region-Level Ridgeline Plot Chart** (top right)

compares average happiness scores across selected regions. This enables users to quickly identify which regions are generally happier or less happy.

The **Summary Table**

complements the visuals by providing exact happiness values, averages, and rankings, allowing for precise data inspection.

Happiness Score Dashboard: 2014–2024

COUNTRY	Min Score (2014–24)	Max Score (2014–24)	2024 Score	2024 vs Avg
Afghanistan	1.3640	3.7940	1.364	
Albania	4.5860	5.4110	5.411	
Algeria	4.8870	6.3550	5.571	
Angola	3.7950	4.0330	NA	
Argentina	5.9290	6.6500	6.397	
Armenia	4.3210	5.4940	5.494	
Australia	6.9740	7.3130	6.974	
Austria	6.8100	7.2942	6.810	
Azerbaijan	4.8750	5.2910	4.875	
Bahrain	5.9590	6.6470	6.030	
Bangladesh	3.8510	5.1550	3.851	
Belarus	5.3230	5.8210	NA	
Belgium	6.8050	6.9370	6.910	
Belize	5.9560	6.7110	6.711	
Benin	3.3400	5.2160	4.357	

1

Summary table that provides detailed happiness statistics (min, max, average, 2024 score) for each country to support precise comparisons.

ABOUT:

World Happiness

Time Series

Panel Model

Clustering

Geospatial

>> Choropleth & Proportional

>> LISA & Moran's I

>> Aspatial

About

About This Dashboard

Project Overview

- This interactive dashboard visualizes global happiness trends from **2014 to 2024**.
- It enables users to explore country-level happiness scores, compare across regions, and identify key drivers using modeling and spatial analysis.

Features

- Time Series: Explore happiness trends, forecasts, and causal impacts
- Panel Model: Fixed effects regression to assess feature importance
- What-If Analysis: Simulate changes to happiness factors
- Clustering: Group similar countries based on happiness indicators
- Geospatial: View Choropleth, Proportional, LISA, and Aspatial maps

Data Source

- The data is sourced from the [World Happiness Report](#), which evaluates well-being across countries using metrics like GDP per capita, social support, healthy life expectancy, freedom, generosity, and corruption perception.

Developer Info

- Created by **Andrea Yeo, Dhreeti Shah, and Ou Yi Ming** as part of the **ISSS608 Visual Analytics Applications (VAA)** subject in the Master of Information Technology program (MITB) at SMU.
- This project combines statistical modeling, data visualization, and geospatial techniques using **R Shiny**.

END