INTERDISCIPLINARY PROJECT REPORT

at

Sathyabama Institute of Science and Technology

(Deemed to be University)

Submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering Degree in Computer Science and Engineering

By

PONDURU SANDEEP

REG. NO. 40110959

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SCHOOL OF COMPUTING

SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY

JEPPIAAR NAGAR, RAJIV GANDHI SALAI,

CHENNAI – 600119, TAMILNADU

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SATHYABAMA

INSTITUTE OF SCIENCE TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

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JEPPIAAR NAGAR, RAJIV GANDHI SALAI

CHENNAI– 600119

www.sathyabama.ac.in

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **"PONDURU SANDEEP" (Reg. No: 40110959)** who carried out the project entitled "**HUMAN DEVELOPMENT INDEX USING IBM WATSON**" under my supervision from August 2022 to October 2022.

Internal Guide

Dr. D. SARAVANAN, M.Tech., Ph.D.,

Head of the Department

Dr. L. LAKSHMANAN, M.E., Ph.D.,

Submitted for Viva voce Examination held on _____

Internal Examiner **External Examiner**

DECLARATION

I, **P. SANDEEP** hereby declare that the project report entitled **"HUMAN DEVELOPMENT INDEX USING IBM WATSON"** done by me under the guidance of **Dr. D. SARAVANAN,** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering Degree in Computer Science and Engineering.

SIGNATURE OF THE CANDIDATE

DATE:

PLACE:

ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to the Board **of Management** of **SATHYABAMA** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my thanks to **Dr. T. Sasikala M.E., Ph.D.**, **Dean**, School of Computing, **Dr. S. Vigneshwari, M.E., Ph.D. and Dr. L. Lakshmanan, M.E., Ph. D., Heads of the Department** of **Computer Science and Engineering** for providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Project Guide **Dr.D.Saravanan, for** his valuable guidance, suggestions and constant encouragement paved the way for the successful completion of my project work.

I wish to express my thanks to all Teaching and Non-teaching staff members of the **Department of Computer Science and Engineering** who were helpful in many ways for the completion of the project

TRAINING CERTIFICATE

ABSTRACT

The Human Development Index (HDI) is a powerful tool that provides a comprehensive measure of a nation's overall well-being. This index was developed by the United Nations Development Program (UNDP) in 1990 and has since become a widely used measure for assessing and comparing the standard of living of countries around the world. The HDI is composed of several key indicators that capture different aspects of human development, such as health, education, and income. Thus, a better understanding of the economic and social progress of countries can be seen through the HDI. In this study, several factors were investigated using multiple linear regression to test their relationships with the HDI. Four independent factors were significant among nine factors, as follows, skilled labor force, R&D expenditure, tourism and export & import. This study uses linear programming to figure out how much development a country needs in these areas to be number one on the HDI index, which in turn will improve the overall quality of life.

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CHAPTER-1

Introduction:

The Human Development Index (HDI) is a statistical composite index of life expectancy, education, and per capita income indicators, which are used to rank countries into four tiers (very high, high, medium & low) of human development. A country scores a higher HDI when the lifespan is higher, the education level is higher, and the gross national income GNI (PPP) per capita is higher. The HDI was created to emphasize that people and their capabilities should be the ultimate criteria for assessing the development of a country, not economic growth alone. The HDI can also be used to question national policy choices, asking how two countries with the same level of GNI per capita can end up withdifferent human development outcomes. In this project we will be building a machine learning model to predict the Human Development Index of a country by taking a few important aspects as inputs. Our model will at last predict the HDI score of a country and will also tell under which category it falls into (very high, high, medium or low).

1.1 Dimensions of HDI

As a statistical tool and a single index that assesses a nation's accomplishments and achievements, HDI aims to determine the three essential components of human advancement; education, health, and decorous living standard. The tool informs about the changes and improvements in human life through its significant social and economic indicators; thus, an appropriate tool to keep records of a nation's economic progress.

HDI Dimensions and Indicators

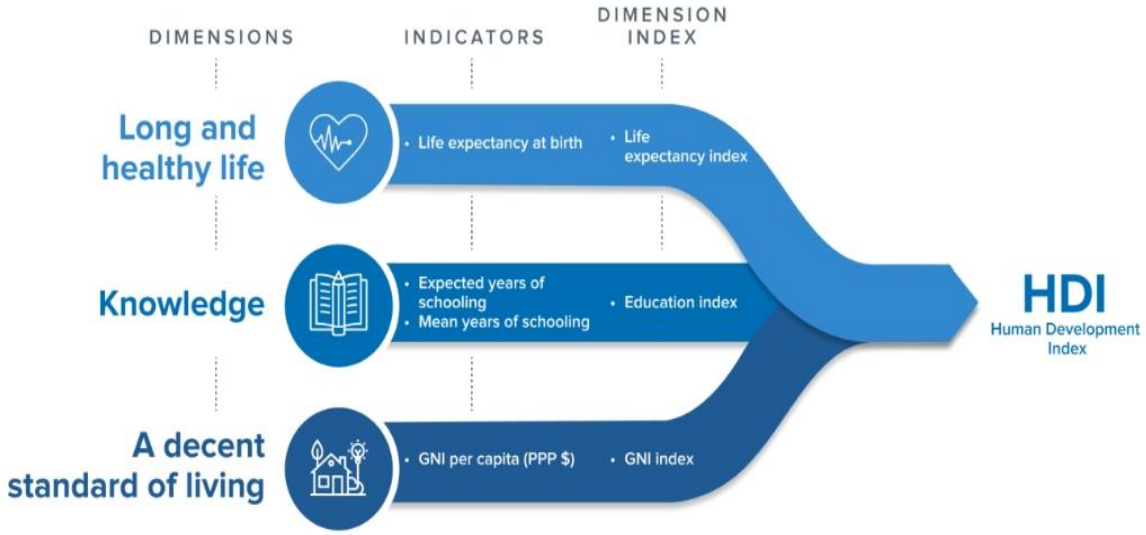


Fig 1: HDI Dimensions and Indicators

Education

This dimension is measured in two levels; the average schooling years for a nation's residents and the anticipated schooling years that children have at the mean age of beginning school. The United Nations indicates that the mean maximum schooling years is 18, and the average full years of schooling is 15.

Long and Healthy Life

This index illustrates the life years that a nation's citizens will enjoy. This component is calculated as the average life expectancy at birth in every country, and it is normalized to zero when the life expectancy at birth is twenty years and one when it is eighty-five years.

Standard of Living

The UNDP uses the adjusted accurate per capita GDP indicator to assess the components of decent standards of living. This metric is typically normalized so that it equals 1 when the actual per capita GDP is $75,000 and zero when the indicator is $100, allowing for a straightforward comparison across countries with wildly different quality of living.

1.2 SUMMARY OF HDI

The Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and having a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions.

The health dimension is assessed by life expectancy at birth, the education dimension is measured by mean of years of schooling for adults aged 25 years and more and expected years of schooling for children of school entering age. The standard of living dimension is measured by gross national income per capita. The HDI uses the logarithm of income, to reflect the diminishing importance of income with increasing GNI. The scores for the three HDI dimension indices are then aggregated into a composite index using geometric mean. Refer to Technical notes for more details.

The HDI can be used to question national policy choices, asking how two countries with the same level of GNI per capita can end up with different human development outcomes. These contrasts can stimulate debate about government policy priorities. The HDI simplifies and captures only part of what human development entails. It does not reflect on inequalities, poverty, human security, empowerment, etc.

The HDRO provides other composite indices as broader proxy on some of the key issues of human development, inequality, gender disparity and poverty. A fuller picture of a country's level of human development requires analysis of other indicators and information presented in the HDR statistical annex

1.3 ORIGINS

The origins of the HDI are found in the annual Human Development Reports produced by the Human Development Report Office of the United Nations Development Programme (UNDP). These were devised and launched by Pakistani economist Mahbub ul Haq in 1990, and had the explicit purpose "to shift the focus of development economics from national income accounting to people-centered policies". Haq believed that a simple composite measure of human development was needed to convince the public, academics, and politicians that they can and should evaluate development not only by economic advances but also improvements in human well-being.

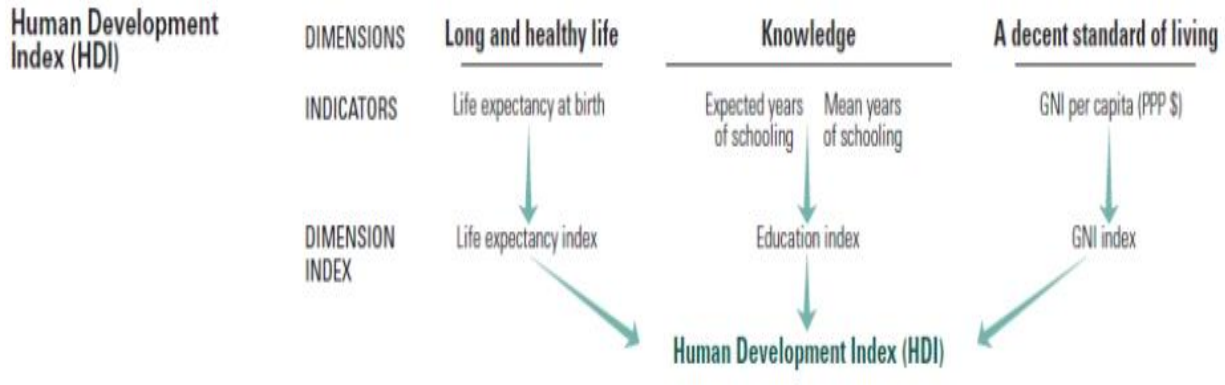


Fig 2: human dimensions indicators and index

CHAPTER-2

2.1 AIM

It was created to re-emphasize that people and their capabilities should be the ultimate criteria for assessing the development of a country, not economic growth. The HDI is used to capture the attention of policy-makers, the media and nongovernmental organizations, and to change the focus from the usual economic

Statistics to human outcomes. The HDI is also used to question national policy choices and to determine how two countries with the same level of income per person can have widely different human development outcomes. For example, two countries may have similar incomes per person, but have drastically differing life expectancy and literacy levels, such that one of the countries has a much higher HDI than the other.

These contrasts stimulate debate on government policies concerning health and education to determine why what can be achieved in one country is beyond the reach of the other. The HDI is also used to highlight differences within countries, between provinces or states, and across genders, ethnicities and other socioeconomic groupings. Highlighting internal disparities along these lines has raised the national debate in many countries.

2.1 Objectives

The main objective of this project is to develop a machine learning model that can accurately predict the age of abalone based on physical characteristics. Specifically, we aim to achieve the following objectives:

- Knowledge on Machine Learning Algorithms.
- Knowledge on Python Language with Machine Learning
- Knowledge on Statistics, Graphs and their relations
- Real Time Analysis of Project
- Building an ease of User Interface (UI)
- Navigation of ideas towards other projects(creativeness)

2.3 System Requirements

2.3.1 Hardware Requirements

Operating system: window 7 and above with 64bit

Processor Type -Intel

Core i3-3220

RAM: 4Gb and above

Hard disk: min 100GB

2.4 Hardware and Software Description

Python

Python is an interpreted, object-oriented, high-level programming language with dynamic semantics. It was created by Guido van Rossum, and first released on February 20, 1991. Its high-level built in data structures, combined with dynamic typing and dynamic binding, make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components together. Python's simple,

easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourages program modularity and code reuse. The Python interpreter and the extensive standard library are available in source or binary form without charge for all major platforms, and can be freely distributed.

Anaconda Navigator

Anaconda Navigator is a free and open source distribution of the python and R programming languages for data science and machine learning related applications. It can be installed on windows, Linux, and macOS. Conda is an open-source, crossplatform, package management system. Anaconda comes with so very nice tools like Jupyter Lab, Jupyter Notebook, QtConsole, Spyder, Glueviz, Orange, Rstudio, Visual Studio Code. For this project, we will be using Jupyter notebook and Spyder.

Jupter Notebook

The Jupyter Notebook is an open source web application that you can use to create and share documents that contain live code, equations, visualizations, and text. Jupyter Notebook is maintained by the people at Project Jupyter. Jupyter Notebooks are a spin-off project from the IPython project, which used to have an IPython Notebook project itself. The name, Jupyter, comes from the core supported programming languages that it supports: Julia, Python, and R. Jupyter ships with the IPython kernel, which allows you to write your programs in Python, but there are currently over 100 other kernels that you can also use.

Spyder

Spyder, the Scientific Python Development Environment, is a free integrated development environment (IDE) that is included with Anaconda. It includes editing, interactive testing, debugging, and introspection features. Initially created and developed by Pierre Raybaut in 2009, since 2012 Spyder has been maintained and continuously improved by a team of scientific Python developers and the community.Spyder is extensible with first-party and third party plugins includes support for interactive tools for data inspection and embeds Pythonspecific code. Spyder is also pre-installed in Anaconda Navigator, which is included in Anaconda.

Flask

Webframework used for building. It is a web application framework written in python which will be running in local browser with a user interface. In this application, whenever the user interacts with UI and selects emoji, it will suggest the best and top movies of that genre to the user.

2.5 LITERATURE SURVEY

2.5.1 EXISTING PROBLEM

In recent years, deep learning has been used in various applications including the classification of ship targets in inland waterways for enhancing intelligent transport systems. Various researchers introduced different classification algorithms, but they still face the problems of low accuracy and misclassification of other target objects. Hence, there is still a need to do more research on solving the above problems to prevent collisions in inland waterways.

2.5.2 PROPOSED SYSTEM

In order to solve the problems for the accuracy of the classification system, we proposed a new classification model. First, based on the pretrained models, the models were fine-tuned with the public dataset we used. Based on their performance, the best model was selected in order to further adjust the performance for high accuracy in classifying ships in inland river waterways. After selecting the best model, the model was adjusted, and classification was conducted based on the modification of the network.

CHAPTER-3

3.1 EXPERIMENTAL INVESTIGATION

The text data need to be organized before proceeding with the project. The original dataset has a single folder. We will be using the HDI.csv file to fetch the text data of training data. The datas need to be unique and all fields need to be filled.The dataset images are to be pre-processed before giving to the model. We will create a function that uses the pre-trained model for predicting custom outputs. Then we have to test and train the model. After the model is build, we will be integrating it to a web application

ARCHITECTURE/FLOW CHART

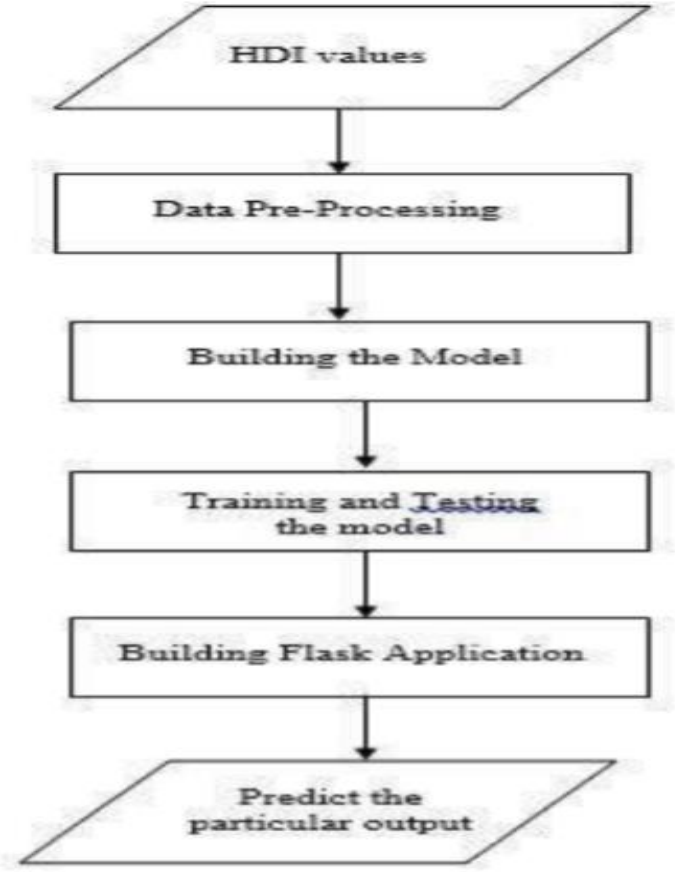


Fig 3: flow chart

3.2 MATERIALS AND METHODS

The primary goal of this research is to predict the future HDI by finding the significant factors that contribute to increasing the HDI. Therefore, multiple linear regression will be utilized to find the association between the HDI as the dependent variable and various independent variables. Moreover, rank the relative importance of the significant factors that contribute to increased HD.

3.2.1 HUMAN DEVELOPMENT INDEX CALCULATION

The HDI is consisting of three fundamental aspects of long- term development: (i) a long and healthy life, (ii) access to education, and (iii) a decent standard of living. The indicators for those dimensions are: life expectancy at birth, expected years of education, mean years of schooling and GNI per capita. They are calculated using mini-mum and maximum values in order to convert indicators expressed in different units into indices ranging from 0 to 1, as follows:

$$\textbf{Dimension index} = \frac{\boldsymbol{actual\ value - minimum\ value}}{\boldsymbol{maximum\ value - minimum\ value}}$$

The three Dimension indices merged into an HDI by using their geometric means. Therefore, the HDI is calculated as follows:

$$\textbf{HDI} = (\boldsymbol{LEI} \,.\, \boldsymbol{II} \,.\, \boldsymbol{EI_{UN}})^{\frac{1}{3}}$$

LEI is the normalized Life Expectancy Index

II is normalized Income Index

EU_{UN} is the normalized Education index

The *LEI*, *II,* and EI_{UN} are defined as follows:

$$\textbf{LEI} = \frac{\boldsymbol{LE_{actual} - LE_{min}}}{\boldsymbol{LE_{max - LE_{min}}}}$$

where LE is the life expectancy at birth [yr], and the actual, max and min are the value of life expectancy at birth in the considered year, its maximum and minimum values adopted for the normalization by the United Nations, respectively. Moreover, the Gross National the normalized Income Index is calculated using equation as follow:

$$II = \frac{ln\left(\frac{GNI_{pc,actual}}{GNI_{pc,min}}\right)}{ln\left(\frac{GNI_{pc,max}}{GNI_{pc,min}}\right)}$$

II analyzed using Gross National Income per capita (GNI pc) at purchasing power parities (PPP) [$pc PPP]. The GNI pc is defined as "the total of value added by all resident producers in the economy plus any product taxes (excluding subsidies) not included in the valuation of output intermediate inputs.

Considering purchasing power parity (PPP) enables to highlight differences in purchasing power between countries by eliminating price level differences. The Income Index is logarithmically normalized in order to account for the diminishing contribution of higher incomes to human development [1]. considers two different information, related both to the average years of education and to the anticipated years of education. It is calculated as the arithmetic mean value of the related indexes, as follows:

$$EI_{UN} = \frac{I_{MYS} - I_{EYS}}{2}$$

Where;

I_{MYS} is the Average Years of Education index, defines as:

$$I_{MYS} = \frac{MYS_{actual} - MYS_{min}}{MYS_{max} - MYS_{min}}$$

where MYS is the Average years of education, which is the average number of completed years of schooling, enrolled by the country's population aged 25 years and older. I_{EYS} is the Expected years of education Index, defined as:

$$I_{EYS} = \frac{EYS_{actual} - EYS_{min}}{EYS_{max} - EYS_{min}}$$

To determine the relationship between HDI and other important factors, multiple regression analysis will be employed in this study. The regression analysis approach is used to determine how a dependent variable may be predicted using an independent variable or variables, and it is defined as: Multiple Regression Calculation

3.2.2 MULTIPLE REGRESSION CALCULATION

$$\mathbf{Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots + \beta_n X_n + \varepsilon}$$

Where;

Y is the dependent variable

$X_1, \ldots\ldots, X_n$ are the independent variables on observation to I

$\beta_0, \ldots\ldots, \beta_n$ are the regression coefficient

Ɛ Error components that represent the deviations of the response from the true relation due to the effects of other factors on the response

The stander error for the estimate, defined as:

$$S_{yx's} = \sqrt{\frac{\sum(Y - \hat{Y})^2}{n-k-1}} = \sqrt{\frac{SSE}{n-k-1}} = \sqrt{MSE}$$

Where:

n is the number of observations

K is the number of independent variables in the regression function

SSE is the residual sum of squares.

MSE is SSE / (n-k-1) the residual mean square.

Coefficient of determination R2, defined as:

$$R^2 = \frac{SSR}{SST} = \frac{\sum(\hat{Y}-\bar{Y})^2}{\sum(Y-\hat{Y})^2} = 1 - \frac{SSE}{SST} = 1 - \frac{\sum(Y-\hat{Y})^2}{\sum(Y-\bar{Y})^2}$$

Correlation matrix Calculation

The Correlation among the independent variable to Answers: how strong is the linear relationship between the variables, defined as:

$$r = \frac{n\sum_{i=1}^{n} x_i y_i - \sum_{i=1}^{n} x_i \sum_{i=1}^{n} y_i}{\sqrt{\left[n\sum_{i=1}^{n} x_i^2 - \left(\sum_{i=1}^{n} x_i\right)^2\right]\left[n\sum_{i=1}^{n} y_i^2 - \left(\sum_{i=1}^{n} y_i\right)^2\right]}}$$

DATA COLLECTION AND APPLICATION

The data was collected from the United Nations Development Program Human Development Reports [12]. Statistical data from 96 countries were collected, including the 2019 Human Development Index (HDI) and other data obtained from the most recent year for which they are available for each country. The factors included in this study as well as the data for each included factor, are illustrated in Table 2 and Table 3, respectively.

Table 2. The independent variables employed in this study

Factors	
Human Development Index (HDI): A composite index measuring average achievement in three basic dimensions of human development—a long and healthy life, knowledge and a decent standard of living	Y
government expenditure on education between 2013 - 2018 (% of GDP): Current, capital and transfer spending on education, expressed as a percentage of GDP.	X_1
Total tax revenue between 2014 - 2019 (% of GDP): Compulsory transfers to the central government for public purposes, expressed as a percentage of GDP.	X_2
The unemployment rate in 2019 (% of the labor force): Percentage of the labour force population ages 15 and older that is not in paid employment or self-employed but is available for work and has taken steps to seek paid employment or self-employment.	X_3
Foreign direct investment net inflows in 2019 (% of GDP): Sum of equity capital, reinvestment of earnings, other long-term capital and short-term capital, expressed as a percentage of GDP.	X_4
Exports and imports in 2019 (% of GDP): Sum of exports and imports of goods and services, expressed as a percentage of gross domestic product (GDP)	X_5
International inbound tourists in 2018 (in thousands) : Arrivals of nonresident visitors (overnight visitors, tourists, same-day visitors and excursionists) at national borders.	X_6
Hospital beds between 2010 – 2019 (per 10,000 people): Number of hospital beds available, expressed per 10,000 people.	X_7
Skilled labor force between 2010 - 2019 (% of the labor force) : Percentage of the labour force ages 15 and older with intermediate or advanced education, as classified by the International Standard Classification of Education.	X_8
Research and development expenditure between 2014 – 2019 (% of GDP): Current and capital expenditures (both public and private) on creative work undertaken systematically to increase knowledge, including knowledge of humanity, culture and society, and the use of knowledge for new applications. Research and development covers basic research, applied research and experimental development.	X_9

ALGORITHM USED

The Human Development Index (HDI) can be calculated using various machine learning algorithms such as linear regression, decision trees, and random forests. The choice of algorithm depends on the available data and the specific problem being addressed.

LINEAR REGRESSION

In general, linear regression is a commonly used algorithm for calculating the HDI. It is a simple and effective algorithm that can be used to model the relationship between the dependent variable (HDI) and independent variables (such as life expectancy, education, and income).

DECISION TREE

Decision trees and random forests are also effective algorithms for calculating the HDI. They are able to handle complex relationships between variables and can capture nonlinear relationships that may not be captured by linear regression.

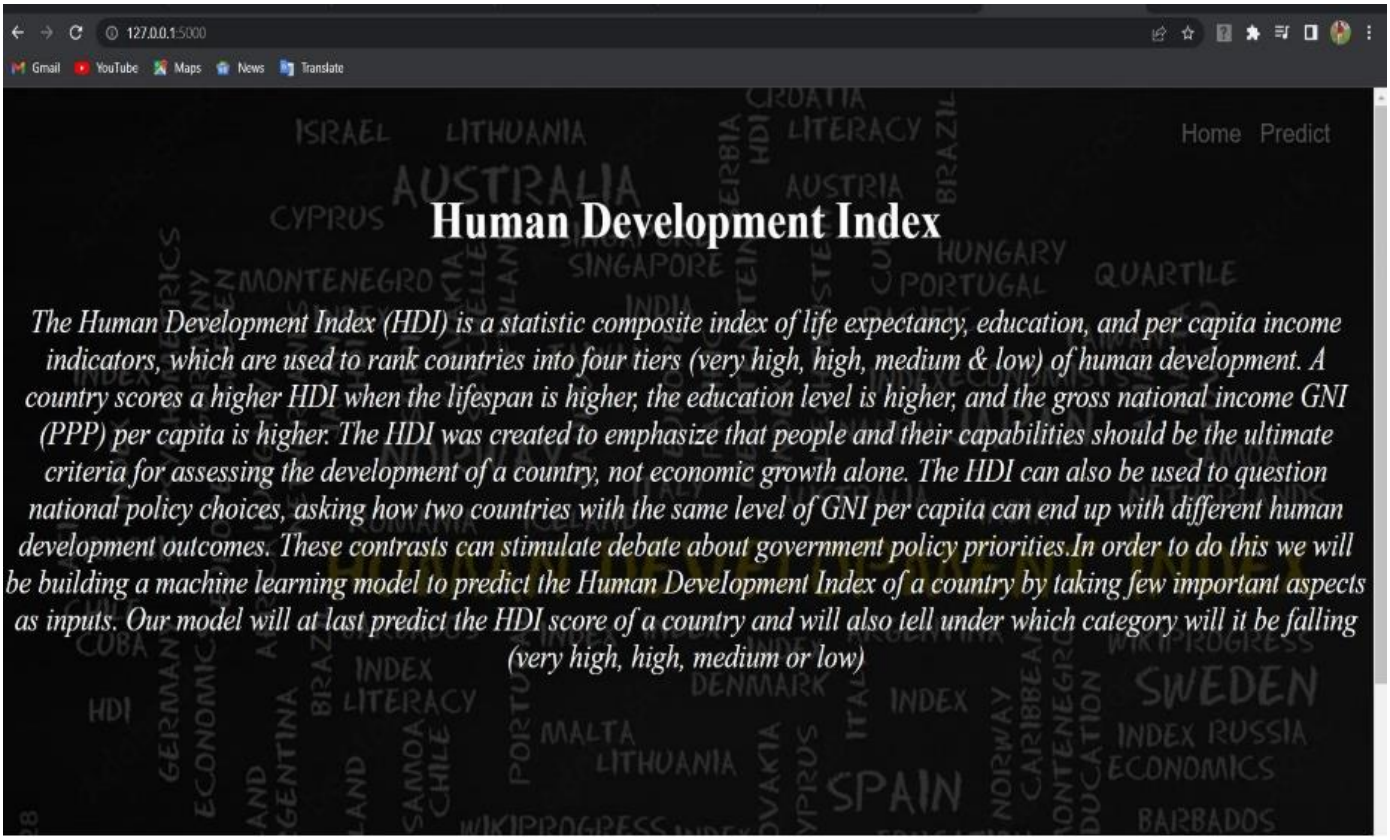
DATASET USED:

	A	B	C	D	E	F	G	H	I	J	K	L	M
1		Id	Country	HDI Rank	HDI	Life expectancy	Mean years of s	Gross national in	GNI per capita ra	Change in HDI ra	Average annual H	Average annual H	Average annual H
2	0	1	Norway	1	0.949	81.7	12.7	67614	5	0	0.77	0.24	0.21
3	1	2	Australia	2	0.939	82.5	13.2	42822	19	1	0.38	0.31	0.24
4	2	3	Switzerland	2	0.939	83.1	13.4	56364	7	0	0.67	0.49	0.16
5	3	4	Germany	4	0.926	81.1	13.2	46000	13	0	0.71	0.59	0.3
6	4	5	Denmark	5	0.925	80.4	12.7	44519	13	2	0.76	0.55	0.32
7	5	6	Singapore	5	0.925	83.2	11.6	78162	-3	0	1.34	1.05	0.3
8	6	7	Netherlands	7	0.924	81.7	11.9	46326	8	-2	0.56	0.37	0.29
9	7	8	Ireland	8	0.923	81.1	12.3	43798	11	1	1.17	0.6	0.29
10	8	9	Iceland	9	0.921	82.7	12.2	37065	20	7	0.7	0.46	0.6
11	9	10	Canada	10	0.92	82.2	13.1	42582	12	1	0.21	0.41	0.38
12	10	11	United States	10	0.92	79.2	13.2	53245	1	-3	0.28	0.29	0.2
13	11	12	Hong Kong, Chin	12	0.917	84.2	11.6	54265	-2	3	0.55	0.85	0.42
14	12	13	New Zealand	13	0.915	82	12.5	32870	20	0	0.61	0.36	0.32
15	13	14	Sweden	14	0.913	82.3	12.3	46251	2	-1	0.73	0.28	0.25
16	14	15	Liechtenstein	15	0.912	80.2	12.4	75065	-11	-5		0.48	0.16
17	15	16	United Kingdom	16	0.909	80.8	13.3	37931	10	-4	1.13	0.41	0.16
18	16	17	Japan	17	0.903	83.7	12.5	37268	10	1	0.51	0.32	0.44
19	17	18	Korea (Republic	18	0.901	82.1	12.2	34541	12	0	1.15	0.76	0.37
20	18	19	Israel	19	0.899	82.6	12.8	31215	16	2	0.81	0.38	0.35
21	19	20	Luxembourg	20	0.898	81.9	12	62471	-12	-4	0.88	0.46	0.11
22	20	21	France	21	0.897	82.4	11.6	38085	4	1	0.86	0.39	0.34
23	21	22	Belgium	22	0.896	81	11.4	41243	1	-4	0.81	0.12	0.27
24	22	23	Finland	23	0.895	81	11.2	38868	1	1	0.9	0.25	0.37
25	23	24	Austria	24	0.893	81.6	11.3	43809	-4	-1	0.53	0.5	0.31
26	24	25	Slovenia	25	0.89	80.6	12.1	28864	13	0	0.73	0.61	0.33
27	25	26	Italy	26	0.887	83.3	10.9	33573	6	0	0.76	0.51	0.34
28	26	27	Spain	27	0.884	82.8	9.8	32779	7	0	0.9	0.49	0.4
29	27	28	Czech Republic	28	0.878	78.8	12.3	28144	11	0	0.76	0.47	0.39
30	28	29	Greece	29	0.866	81.1	10.5	24808	16	0	0.52	0.71	0.14
31	29	30	Brunei Darussala	30	0.865	79	9	72843	-25	1	0.46	0.33	0.43
32	30	31	Estonia	30	0.865	77	12.5	26362	12	2	0.71	0.7	0.65
33	31	32	Andorra	32	0.858	81.5	10.3	47979	-18	9			0.95
34	32	33	Cyprus	33	0.856	80.3	11.7	29459	4	-3	0.88	0.58	0.2
35	33	34	Malta	33	0.856	80.7	11.3	29500	3	3	0.63	0.53	0.71
36	34	35	Qatar	33	0.856	78.3	9.8	129916	-32	2	0.71	0.22	0.68
37	35	36	Poland	36	0.855	77.6	11.9	24117	11	-3	0.97	0.56	0.62
38	36	37	Lithuania	37	0.848	73.5	12.7	26006	7	-1	0.36	0.87	0.53
39	37	38	Chile	38	0.847	82	9.9	21665	16	2	0.84	0.75	0.65
40	38	39	Saudi Arabia	38	0.847	74.4	9.6	51320	-26	9	0.61	0.8	1.05
41	39	40	Slovakia	40	0.845	76.4	12.2	26764	1	-7	0.34	0.83	0.39
42	40	41	Portugal	41	0.843	81.2	8.9	26104	2	1	0.97	0.46	0.59
43	41	42	United Arab Emi	42	0.84	77.1	9.5	66203	-35	-4	0.94	0.32	0.38
44	42	43	Hungary	43	0.836	75.3	12	23394	6	-4	0.89	0.67	0.36
45	43	44	Latvia	44	0.83	74.3	11.7	22589	7	1	0.35	1.07	0.49
46	44	45	Argentina	45	0.827	76.5	9.9	20945	12	-2	0.9	0.57	0.28
47	45	46	Croatia	45	0.827	77.5	11.2	20291	14	1	1.13	0.77	0.47
48	46	47	Bahrain	47	0.824	76.7	9.4	37236	-19	-3	0.63	0.23	0.29
49	47	48	Montenegro	48	0.807	76.4	11.3	15410	24	2			0.38
50	48	49	Russian Federati	49	0.804	70.3	12	23286	1	5	-0.18	0.87	0.48
51	49	50	Romania	50	0.802	74.8	10.8	19428	11	-2	0.11	1.2	0.12
52	50	51	Kuwait	51	0.8	74.5	7.3	76075	-48	-1	0.98	0.07	0.21
53	51	52	Belarus	52	0.796	71.5	12	15629	19	1		1.45	0.23
54	52	53	Oman	52	0.796	77	8.1	34402	-21	-3		1.25	-0.04
55	53	54	Barbados	54	0.795	75.8	10.5	14952	20	2	0.49	0.39	0.37
56	54	55	Uruguay	54	0.795	77.4	8.6	19148	8	2	0.7	0.5	0.37
57	55	56	Bulgaria	56	0.794	74.3	10.8	16261	13	3	0.19	0.83	0.49
58	56	57	Kazakhstan	56	0.794	69.6	11.7	22093	-3	7	-0.07	1.13	0.72
59	57	58	Bahamas	58	0.792	75.6	10.9	21565	-3	-6		0.13	0.08
60	58	59	Malaysia	59	0.789	74.9	10.1	24620	-13	1	1.2	0.67	0.39
61	59	60	Palau	60	0.788	72.9	12.3	13771	21	2		0.38	0.47
62	60	61	Panama	60	0.788	77.8	9.9	19470	0	4	0.86	0.5	0.76
63	61	62	Antigua and Barl	62	0.786	76.2	9.2	20907	-4	-7			0.08
64	62	63	Seychelles	63	0.782	73.3	9.4	23886	-15	11		0.41	1.02
65	63	64	Mauritius	64	0.781	74.6	9.1	17948	1	6	0.83	1.05	0.89
66	64	65	Trinidad and Tob	65	0.78	70.5	10.9	28049	-25	-5	0.65	0.79	0.16
67	65	66	Costa Rica	66	0.776	79.6	8.7	14006	14	3	0.82	0.61	0.64
68	66	67	Serbia	66	0.776	75	10.8	12202	22	0	-0.07	0.65	0.5
69	67	68	Cuba	68	0.775	79.6	11.8	7465	48	-12	0.15	1.28	-0.13
70	68	69	Iran (Islamic Rep	69	0.774	75.6	8.8	16395	-2	3	1.53	1.12	0.78
71	69	70	Georgia	70	0.769	75	12.2	8856	38	5		0.99	0.72
72	70	71	Turkey	71	0.767	75.5	7.9	18705	-7	9	1.26	1.22	0.81
73	71	72	Venezuela (Boliv	71	0.767	74.4	9.4	15129	2	-4	0.58	1.18	0.29
74	72	73	Sri Lanka	73	0.766	75	10.9	10789	21	-2	0.92	0.84	0.56
75	73	74	Saint Kitts and N	74	0.765	74	8.4	22436	-22	2			0.64
76	74	75	Albania	75	0.764	78	9.6	10252	24	4	0.41	1.1	0.7
77	75	76	Lebanon	76	0.763	79.5	8.6	13312	8	-12			0.14
78	76	77	Mexico	77	0.762	77	8.6	16383	-9	-5	0.77	0.63	0.44
79	77	78	Azerbaijan	78	0.759	70.9	11.2	16413	-12	-2		1.43	0.48
80	78	79	Brazil	79	0.754	74.7	7.8	14145	-1	7	1.15	0.55	0.83
81	79	80	Grenada	79	0.754	73.6	8.6	11502	13	-3			0.33
82	80	81	Bosnia and Herz	81	0.75	76.6	9	10091	22	14			1.07
83	81	82	The former Yugo	82	0.748	75.5	9.4	12405	5	0			0.35
84	82	83	Algeria	83	0.745	75	7.8	13533	-1	3	1.11	1.18	0.56
85	83	84	Armenia	84	0.743	74.9	11.3	8189	28	1	0.16	1.24	0.39
86	84	85	Ukraine	84	0.743	71.1	11.3	7361	34	-1	-0.48	0.87	0.25
87	85	86	Jordan	86	0.741	74.2	10.1	10111	15	-6	1.31	0.43	0.13
88	86	87	Peru	87	0.74	74.8	9	11295	6	3	1.01	0.63	0.53
89	87	88	Thailand	87	0.74	74.6	7.9	14519	-11	4	1.25	1.03	0.56
90	88	89	Ecuador	89	0.739	76.1	8.3	10536	6	7	0.41	0.58	0.83
91	89	90	China	90	0.738	76	7.6	13345	-7	11	1.72	1.7	1.05
92	90	91	Fiji	91	0.736	70.2	10.5	8245	20	6	0.64	0.37	0.75
93	91	92	Mongolia	92	0.735	69.8	9.8	10449	4	8	0.17	1.77	0.94
94	92	93	Saint Lucia	92	0.735	75.2	9.3	9791	14	-8		0.69	0.06
95	93	94	Jamaica	94	0.73	75.8	9.6	8350	16	-6	0.44	0.6	0.22
96	94	95	Colombia	95	0.727	74.2	7.6	12762	-10	6	0.99	0.7	0.76
97	95	96	Dominica	96	0.726	77.9	7.9	10096	6	-8		0.38	0.13
98	96	97	Suriname	97	0.725	71.3	8.3	16018	-27	1			0.58
99	97	98	Tunisia	97	0.725	75	7.1	10249	3	-5	1.4	0.88	0.29
100	98	99	Dominican Repul	99	0.722	73.7	7.7	12756	-13	0	0.96	0.69	0.54
101	99	100	Saint Vincent an	99	0.722	73	8.6	10372	-1	-6		0.55	0.28
102	100	101	Tonga	101	0.721	73	11.1	5284	33	-8	0.38	0.56	0.24
103	101	102	Libya	102	0.716	71.8	7.3	14303	-25	-35	0.72	0.32	-1.06
104	102	103	Belize	103	0.706	70.1	10.5	7375	14	-2	0.43	0.33	0.19
105	103	104	Samoa	104	0.704	73.7	10.3	5372	27	0	0.75	0.72	0.32
106	104	105	Maldives	105	0.701	77	6.2	10383	-8	10		1.24	1.11
107	105	106	Uzbekistan	105	0.701	69.4	12	5748	21	6		1.12	1.07
108	106	107	Moldova (Republi	107	0.699	71.7	11.9	5026	31	0	-0.87	1.18	0.81
109	107	108	Botswana	108	0.698	64.5	9.2	14863	-33	-3	-0.43	1.93	0.56
110	108	109	Gabon	109	0.697	64.9	8.1	19044	-46	5	0.2	0.48	0.97
111	109	110	Paraguay	110	0.693	73	8.1	8182	3	-4	0.73	0.79	0.54
112	110	111	Egypt	111	0.691	71.3	7.1	10064	-7	-3	1.12	0.93	0.6
113	111	112	Turkmenistan	111	0.691	65.7	9.9	14026	-32	2			0.78
114	112	113	Indonesia	113	0.689	69.1	7.9	10053	-8	3	1.36	0.92	0.78
115	113	114	Palestine, State	114	0.684	73.1	8.9	5256	21	-5			0.45

114	112	113	Indonesia	113	0.689	69.1	7.9	10053	-8	3	1.36	0.92	0.78
115	113	114	Palestine, State	114	0.684	73.1	8.9	5256	21	-5			0.45
116	114	115	Viet Nam	115	0.683	75.9	8	5335	18	2	1.92	1.29	0.85
117	115	116	Philippines	116	0.682	68.3	9.3	8395	-7	-7	0.6	0.72	0.39
118	116	117	El Salvador	117	0.68	73.3	6.5	7732	-3	-6	1.52	0.8	0.41
119	117	118	Bolivia (Plurinatic	118	0.674	68.7	8.2	6155	6	0	1.26	0.66	0.77
120	118	119	South Africa	119	0.666	57.7	10.3	12087	-30	2	0.13	0.14	0.89
121	119	120	Kyrgyzstan	120	0.664	70.8	10.8	3097	32	3	-0.37	0.65	0.98
122	120	121	Iraq	121	0.649	69.6	6.6	11608	-30	-3	0.59	0.67	0.01
123	121	122	Cabo Verde	122	0.648	73.5	4.8	6049	3	1		1.19	0.5
124	122	123	Morocco	123	0.647	74.3	5	7195	-4	4	1.46	1.47	1.12
125	123	124	Nicaragua	124	0.645	75.2	6.5	4747	16	2	1.42	0.83	0.82
126	124	125	Guatemala	125	0.64	72.1	6.3	7063	-4	5	1.34	1.09	1
127	125	126	Namibia	125	0.64	65.1	6.7	9770	-18	2	-0.39	0.96	0.91
128	126	127	Guyana	127	0.638	66.5	8.4	6884	-5	-2	1.14	0.29	0.45
129	127	128	Micronesia (Fede	127	0.638	69.3	9.7	3291	22	-6		0.56	-0.01
130	128	129	Tajikistan	129	0.627	69.6	10.4	2601	30	2	-1.39	1.28	0.64
131	129	130	Honduras	130	0.625	73.3	6.2	4466	11	-1	0.94	0.94	0.45
132	130	131	India	131	0.624	68.3	6.3	5663	-4	4	1.45	1.62	1.46
133	131	132	Bhutan	132	0.607	69.9	3.1	7081	-12	5			1.19
134	132	133	Timor-Leste	133	0.605	68.5	4.4	5371	-1	-1		2.57	-0.03
135	133	134	Vanuatu	134	0.597	72.1	6.8	2805	23	-1			0.2
136	134	135	Congo	135	0.592	62.9	6.3	5503	-7	3	-0.67	1.38	1.2
137	135	136	Equatorial Guine	135	0.592	57.9	5.5	21517	-79	0		0.96	0.44
138	136	137	Kiribati	137	0.588	66.2	7.8	2475	23	-3			0.1
139	137	138	Lao People's Der	138	0.586	66.6	5.2	5049	-2	5	1.54	1.59	1.59
140	138	139	Bangladesh	139	0.579	72	5.2	3341	8	2	1.95	1.54	1.21
141	139	140	Ghana	139	0.579	61.5	6.9	3839	5	0	0.63	1.34	0.88
142	140	141	Zambia	139	0.579	60.8	6.9	3464	7	3	0.64	2.5	1.3
143	141	142	Sao Tome and P	142	0.574	66.6	5.3	3070	12	-2	0.91	0.94	1
144	142	143	Cambodia	143	0.563	68.8	4.7	3095	10	1	1.46	2.61	1.09
145	143	144	Nepal	144	0.558	70	4.1	2337	19	2	1.66	1.73	1.07
146	144	145	Myanmar	145	0.556	66.1	4.7	4943	-6	2	1.9	2.12	1.1
147	145	146	Kenya	146	0.555	62.2	6.3	2881	10	-1	-0.57	1.72	0.9
148	146	147	Pakistan	147	0.55	66.4	5.1	5031	-10	2	1.09	1.55	0.95
149	147	148	Swaziland	148	0.541	48.9	6.8	7522	-33	-1	-0.78	0.38	0.57
150	148	149	Syrian Arab Rep	149	0.536	69.7	5.1	2441	13	-29	0.58	0.94	-3.68
151	149	150	Angola	150	0.533	52.7	5	6291	-27	4		2.38	1.49
152	150	151	Tanzania (United	151	0.531	65.5	5.8	2467	10	1	0.57	2.45	1.27
153	151	152	Nigeria	152	0.527	53.1	6	5443	-23	-1			1.08
154	152	153	Cameroon	153	0.518	56	6.1	2894	2	5	-0.15	1.06	1.27
155	153	154	Papua New Guin	154	0.516	62.8	4.3	2712	4	1	1.6	1.57	0.9
156	154	155	Zimbabwe	154	0.516	59.2	7.7	1588	20	15	-1.55	0.57	2.67
157	155	156	Solomon Islands	156	0.515	68.1	5.3	1561	19	-3		1.19	0.71
158	156	157	Mauritania	157	0.513	63.2	4.3	3527	-12	0	1.62	0.94	1.04
159	157	158	Madagascar	158	0.512	65.5	6.1	1320	25	-8		1.01	0.33
160	158	159	Rwanda	159	0.498	64.7	3.8	1617	14	4	3.14	3.39	1.4
161	159	160	Comoros	160	0.497	63.6	4.8	1335	22	-1			0.78
162	160	161	Lesotho	160	0.497	50.1	6.1	3319	-12	2	-1.06	0.56	1.2
163	161	162	Senegal	162	0.494	66.9	2.8	2250	3	4	0.37	1.8	1.65
164	162	163	Haiti	163	0.493	63.1	5.2	1657	9	-2	0.82	0.6	0.96
165	163	164	Uganda	163	0.493	59.2	5.7	1670	8	-3	2.51	1.88	0.66
166	164	165	Sudan	165	0.49	63.7	3.5	3848	-22	-1	1.89	1.49	1.15
167	165	166	Togo	166	0.487	60.2	4.7	1262	18	-1	0.53	0.69	1.32
168	166	167	Benin	167	0.485	59.8	3.5	1979	1	0	1.38	1.4	1.32
169	167	168	Yemen	168	0.482	64.1	3	2300	-4	-12	0.91	1.06	-0.44
170	168	169	Afghanistan	169	0.479	60.7	3.6	1871	1	-2	1.43	2.95	1.09
171	169	170	Malawi	170	0.476	63.9	4.4	1073	16	1	1.74	1.4	1.38
172	170	171	CÃ´te d'Ivoire	171	0.474	51.9	5	3163	-20	1	0.16	1.11	1.43
173	171	172	Djibouti	172	0.473	62.3	4.1	3216	-22	-2		2.19	0.98
174	172	173	Gambia	173	0.452	60.5	3.3	1541	3	-1	1.54	1.4	0.46
175	173	174	Ethiopia	174	0.448	64.6	2.6	1523	5	1		3.79	1.71
176	174	175	Mali	175	0.442	58.5	2.3	2218	-9	4	2.94	3.14	1.82
177	175	176	Congo (Democra	176	0.435	59.1	6.1	680	15	4	-0.73	1.89	1.79
178	176	177	Liberia	177	0.427	61.2	4.4	683	13	0		0.51	1
179	177	178	Guinea-Bissau	178	0.424	55.5	2.9	1369	3	-2			0.67
180	178	179	Eritrea	179	0.42	64.2	3.9	1490	1	-1			0.74
181	179	180	Sierra Leone	179	0.42	51.3	3.3	1529	-1	3	1.04	2.65	1.39
182	180	181	Mozambique	181	0.418	55.5	3.5	1098	4	0	3.63	2.9	1.03
183	181	182	South Sudan	181	0.418	56.1	4.8	1882	-12	-7			-0.49
184	182	183	Guinea	183	0.414	59.2	2.6	1058	4	0	1.74	1.8	1.45
185	183	184	Burundi	184	0.404	57.1	3	691	5	-1	-0.06	3.67	0.97
186	184	185	Burkina Faso	185	0.402	59	1.4	1537	-8	0			1.27
187	185	186	Chad	186	0.396	51.9	2.3	1991	-19	0		2.13	1.37
188	186	187	Niger	187	0.353	61.9	1.7	889	1	1	1.85	2.41	1.76
189	187	188	Central African R	188	0.352	51.5	4.2	587	4	-1	-0.19	1.41	-0.47
190	188	189	Korea (Democratic People's Rep. of)			70.5							
191	189	190	Marshall Islands					4412					
192	190	191	Monaco										
193	191	192	Nauru					12058					
194	192	193	San Marino					50063					
195	193	194	Somalia			55.7		294					
196	194	195	Tuvalu					5395					
197													
198													

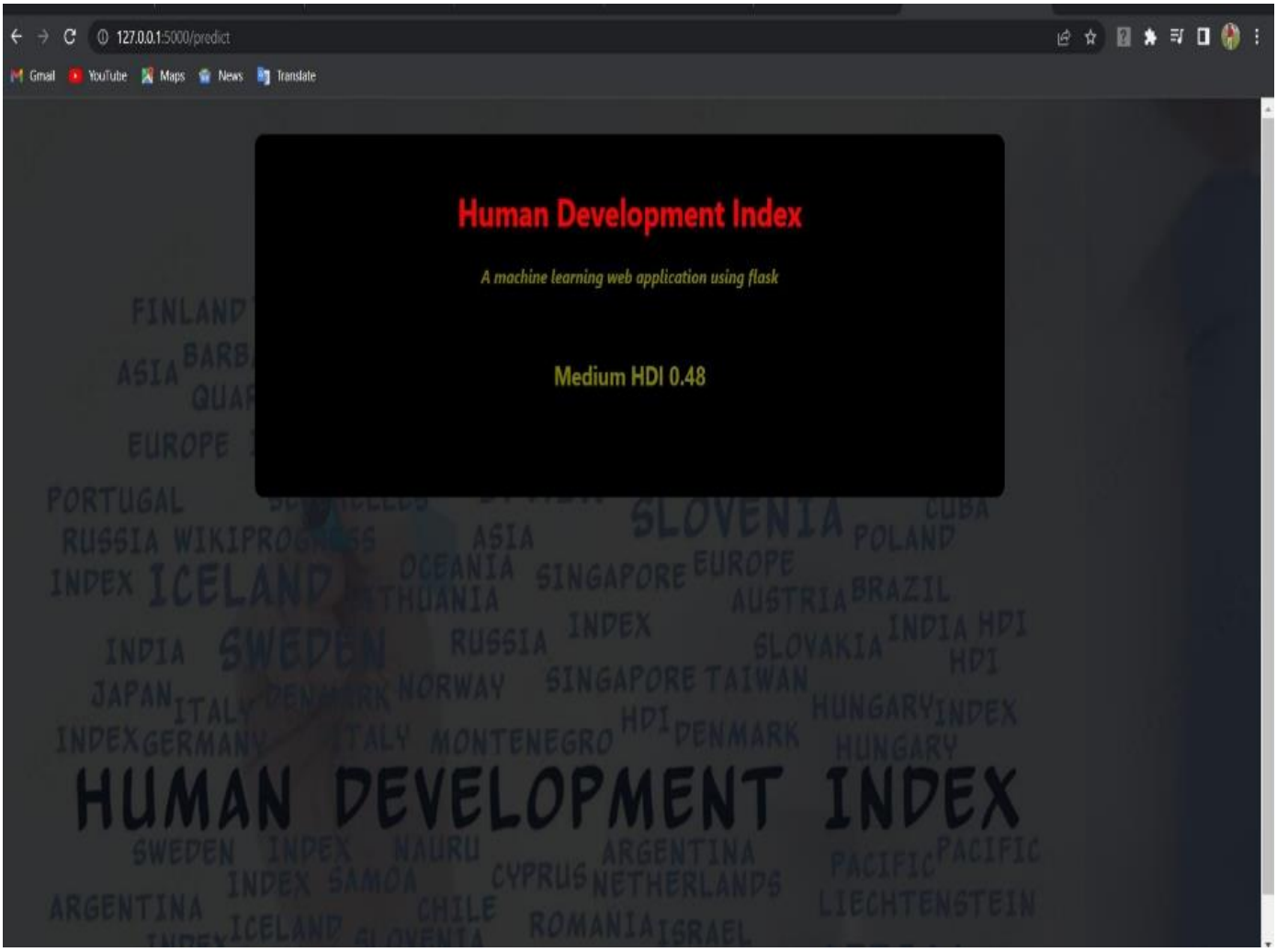
TABLE 2: THE DATA FOR THE HDI INDEXES AND THE INDEPENDENT VARIABLES EMPLOYED IN THIS STUDY FOR 194 COUNTRIES

Result:


127.0.0.1:5000
Gmail YouTube Maps News Translate
Home Predict
Human Development Index
The Human Development Index (HDI) is a statistic composite index of life expectancy, education, and per capita income indicators, which are used to rank countries into four tiers (very high, high, medium & low) of human development. A country scores a higher HDI when the lifespan is higher, the education level is higher, and the gross national income GNI (PPP) per capita is higher. The HDI was created to emphasize that people and their capabilities should be the ultimate criteria for assessing the development of a country, not economic growth alone. The HDI can also be used to question national policy choices, asking how two countries with the same level of GNI per capita can end up with different human development outcomes. These contrasts can stimulate debate about government policy priorities.In order to do this we will be building a machine learning model to predict the Human DeveIopment Index of a country by taking few important aspects as inputs. Our model will at last predict the HDI score of a country and will also tell under which category will it be falling (very high, high, medium or low)


127.0.0.1:5000/Prediction
Gmail YouTube Maps News Translate
Human Development Index
Select the name of the Country
Enter life expectancy rate(range 50-89)
Enter Mean years of schooling(range 1-15)
Enter GNI(range 290-129000)
Enter the number of internet users
Predict


127.0.0.1:5000/Prediction
Gmail
YouTube
Maps
News
Translate
Human Development Index
India
70
1
556
10
Predict
HDI Human Development Index
#385022542
Ctrl


127.0.0.1:5000/predict
Gmail
YouTube
Maps
News
Translate
Human Development Index
A machine learning web application using flask
Medium HDI 0.48
HUMAN DEVELOPMENT INDEX

CHAPTER-5

5.1 CONCLUSION

project was about classifying the countries based on their human development index. This project improved the performance of the classification model for classifying people accordingly. The new proposed method achieved high accuracy compared with the other existing algorithms. It was compared with other existing algorithms in classifying different classes of ships in inland waterways, and our proposed method achieved better results compared with the others.

5.2 FUTURE SCOPE

In future works, the proposed method will be improved in order to classify the people in different countries with extra features using more advanced technology.

SOURCECODES

APP.PY

```
import numpy as np
import pandas as pd
from flask import Flask, render_template, request
import pickle
model = pickle.load(open(r'D:\HDI\Flask\HDI.pkl','rb'))
app = Flask(__name__)
@app.route('/')
def home():
return render_template('home.html')
@app.route('/Prediction',methods=['POST','GET'])
def prediction():
return render_template('indexnew.html')
@app.route('/Home',methods=['POST','GET'])
def my_home():
return render_template('home.html')
@app.route('/predict',methods=['POST'])
def predict():
input_features = [float(x) for x in request.form.values()]
print(input_features)
features_value = [np.array(input_features)]
features_name = ['Country','Life expectancy','Mean years of schooling','Gross
national income (GNI) per capita','Internet Users']
df = pd.DataFrame(features_value, columns=features_name)
model = pickle.load(open(r'D:\HDI\Flask\HDI.pkl', 'rb'))
output = model.predict(df)
print(round(output[0][0],2))
y_pred =round(output[0][0],2)
if(y_pred >= 0.3 and y_pred <= 0.4) :
return render_template("resultnew.html",prediction_text = 'Low HDI'+
str(y_pred))
elif(y_pred >= 0.4 and y_pred <= 0.7) :
return render_template("resultnew.html",prediction_text = 'Medium HDI
```

```
'+str(y_pred))
elif(y_pred >= 0.7 and y_pred <= 0.8) :
return render_template("resultnew.html",prediction_text = 'High
HDI'+str(y_pred))
elif(y_pred >= 0.8 and y_pred <= 0.94)
return render_template("resultnew.html",prediction_text = 'Very High
HDI'+str(y_pred))
else :
return render_template("resultnew.html",prediction_text = 'The given values do
not match the range of values of the model.Try giving the values in the mentioned
range'+str(y_pred))
return render_template('resultnew.html', prediction_text=y_pred)
if __name__ == '__main__':
app.run(debug=False,port=5000):
```

home.html

```
<!DOCTYPE html>
<html>
<head>
<title>Home</title>
<style>
.navbar
{
margin: 0px;
padding:20px;
background-color:;
opacity:0.6;
color:black;
font-family:'Roboto',sans-serif;
font-style: italic;
border-radius:20px;
font-size:25px;
}
a
{
color:grey;
float:right;
text-decoration:none;
font-style:normal;
```

```
padding-right:20px;
}
a:hover{
background-color:black;
color:white;
border-radius:15px;0
font-size:30px;
padding-left:10px;
}
p
{
color:white;
font-style:italic;
font-size:30px;
}
body
{
background:lineargradient(rgba(0,0,0,0.8),rgba(0,0,0,0.8)),url("https://as2.ftcdn.net/v
2/jpg/01/16/98/39/1000_F_116983928_Z5QD7UDlwukiVWx6GKturYgtwWohM5kl.
jpg");
height: 125vh;
-webkit-background-size: cover;
background-size:cover;
background-position: center center;
position: relative;
}
</style>
</head>
<body>
<div class="navbar">
<a href="/Prediction" >Predict</a>
<a href="/Home">Home</a>
<br>
</div>
```


Human DevelopmentIndex

The Human Development Index (HDI) is a statistic composite index of life expectancy, education, and per capita income indicators, which are used to rank countries into four tiers (very high, high, medium & low)of human development. A country scores a higher HDI when the lifespan is higher, the education level is higher, and the gross national income GNI (PPP) per capita is higher. The HDI was created to emphasize that people and their capabilities should be the ultimate criteria for assessing the development of a country, not economic growth alone. The HDI can also be used to question national policy choices, asking how two countries with the same level of GNI per capita can end up with different human development outcomes. These contrasts can stimulate debate about government policy priorities.In order to do this we will be building a machine learning model to predict the Human DeveIopment Index of a country by taking few important aspects as inputs. Our model will at last predictthe HDI score of a country and will also tell under which category will it be falling (very high, high, medium or low)

</body>
</html>

indexnew.html

```
<html>
<style>
div.header1{
top:20;
position: fixed;
padding-left: 490px;
}
*{
margin:0;
padding:0;
border:0;
outline:0;
text-decoration:none;
font-family:montserrat;
}
body
{
background-
image:url('https://as2.ftcdn.net/v2/jpg/03/85/02/25/1000_F_385022542_kJWoZb9N
WBLFnCpcC7ZYD4KQ4EYQUQz5.jpg');
background-position: center;
font-family:sans-serif;
background-size:cover;
margin-top:40px;
}
.main{
background-color:rgb(0,0,0,0.6);
width:800px;
height:590px;
margin:auto;
position:center;
border-top-left-radius:100px;
border-bottom-right-radius:100px;
}
.main input[type="text"],.main input[type="text"],.main input[type="text"],.main
input[type="text"],.main input[type="text"],.main input[type="text"],.main
input[type="text"]{
border:0;
background:none;
display:block;
margin:20px auto;
text-align:center;
border:2px solid #3498db;
padding:10px 3px;
width:280px;
outline:none;
color:white;
border-radius:24px;
transition:0.25s;
}
```

```
.bor{
border:0;
background:none;
display:block;
margin:20px auto;
text-align:center;
border:2px solid #8e44ad;
padding:10px 3px;
width:500px;
outline:none;
color:white;
transition:0.25s;}
.main input[type="text"]:focus,.main input[type="text"]:focus,.main
input[type="text"]:focus,.main input[type="text"]:focus,.main
input[type="text"]:focus,.main input[type="text"]:focus,.main
input[type="text"]:focus{
width:280px;
border-color:#8e44ad;
}
.logbtn{
display:block;
width:35%;
height:50px;
border:none;
border-radius:24px;
background:linear-gradient(120deg,#3498db,#8e44ad,#3498db,#8e44ad);
background-size:200%;
color:#fff;
outline:none;
cursor:pointer;
transition:.5s;
font-size:25;
}
.logbtn:hover{
background-position:right;
}
input::placeholder{
color:#F5FFFA;
}
.bottom-text{
margin-top:60px;
text-align:center;
font-size:13px;
}
</style>
<body>
<center><div class="header1"><font color="#FF0000" font-
family="Fascinate Inline" size=7 ><b>Human Development Index
</b></font></div></center>
<br><br><br><br><br>
<form class="main" action="/predict" method="post">
<br>
```

```
<center><select id="Country" name="Country">
<option value="">Select the name of the Country</option>
<option value="0">Afganistan</option>
<option value="8">Australia</option>
<option value="13">Bangladesh</option>
<option value="31">Canada</option>
<option value="76">India</option>
<option value="138">Poland</option>
<option value="179">Turkey</option>
</select></center>
<input class="form-input" type="text" name='Life expectancy' placeholder="Enter
life expectancy rate(range 50-89)"><br>
<input class="form-input" type="text" name='Mean years of schooling'
placeholder="Enter Mean years of schooling(range 1-15)"><br>
<input class="form-input" type="text" name='Gross national income (GNI) per capita'
placeholder="Enter GNI(range 290-129000)"><br>
<input class="form-input" type="text" name='Internet users' placeholder="Enter the
number of internet users"><br>
<center><input type="submit" class="logbtn"
value="Predict"></center>
<divclass="bor"><center><b><fontcolor="white"size=5>{{showcase}}</font></b><
/center></div></form>
</body>
</html>
```

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