Computers and Information Technology Department Faculty of Egyptian E-Learning University

GRADUATION PROJECT SUBMITTED IN:

Cryptocurrency Analysis and Price Prediction

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Abstract

Analyzing cryptocurrencies and predicting their prices represents a significant challenge in the digital economy, necessitating a deep understanding of market volatility and precise forecasting methods. This project leverages the rapid advancements in artificial intelligence and data analytics to address these challenges, enhancing the accuracy of cryptocurrency price predictions. Through an extensive literature review and the application of various data analysis techniques, the study explores the intricate dynamics of the cryptocurrency market. By employing machine learning algorithms and statistical models, predictive models are developed to forecast cryptocurrency prices. The findings provide valuable insights into the influential factors affecting market trends and offer practical recommendations for investors and researchers. This project not only advances the understanding of cryptocurrency price movements but also contributes to the development of more effective trading strategies in the digital economy.

Acknowledgments

First, we would like to thank Allah for helping us to complete this project successfully. We are heartily thankful to Dr. Samar Hesham, who not only served as our official advisor but also guided, encouraged, and challenged us throughout the project. Her great dedication and insistence on the best from us allowed for the completion and success of this project. We also extend our gratitude to TA Almohanad Alaa Eldeen for his continuous support and valuable insights, which greatly contributed to the success of this project. Finally, we owe our deepest gratitude to our families for their great support, without which our work would not have been successful. Let's not forget our families in Palestine and don't believe any negative things said about them. Always be their protection, their joy, and their voice. This is something we can do with minimal effort, but its reward and impact are greater than we can imagine. God willing, their victory and the victory of all Muslims will be near and great..

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Introduction:

Cryptocurrency is a recent financial phenomenon that has revolutionized how individuals and institutions interact with money. Since the launch of Bitcoin in 2009, the cryptocurrency market has experienced tremendous growth and diversification, with thousands of new digital currencies emerging and being increasingly adopted across various sectors. In this context, cryptocurrency analysis and price prediction have become critically important topics for both investors and financial analysts.

The cryptocurrency market is characterized by extreme volatility and difficulty in predicting its movements, making the analysis and forecasting of prices a significant challenge. Traditional market analysis relies on principles of technical and fundamental analysis. In technical analysis, historical market data such as prices and trading volumes are used to attempt to predict future trends. Fundamental analysis, on the other hand, focuses on studying the economic, technological, and regulatory factors that may affect a currency's value.

With the rapid evolution of technology, artificial intelligence and machine learning tools have become key factors that can contribute to improving the accuracy of cryptocurrency price predictions. These tools provide the ability to process and analyze vast amounts of data quickly and efficiently, enabling the extraction of accurate insights into future market trends.

In this project, we aim to develop a web-based platform known as "CryptoPredict" that aims to provide comprehensive analysis and accurate future predictions of cryptocurrency prices. The platform will rely on integrating technical and fundamental analysis with artificial intelligence and machine learning techniques. Market data will be collected and analyzed using advanced algorithms to provide reliable forecasts that help investors make informed decisions.

What is the cryptocurrency:

Cryptocurrency is a digital or virtual form of currency that utilizes cryptography for security and operates on decentralized networks based on blockchain technology. Unlike traditional currencies issued by governments (fiat currencies), cryptocurrencies are not regulated or controlled by any central authority, such as a central bank. Instead, they rely on distributed ledger technology, typically a blockchain, to record transactions and manage the issuance of new units.

The most well-known cryptocurrency is Bitcoin, which was created in 2009 by an anonymous person or group using the pseudonym Satoshi Nakamoto. Since then, thousands of other cryptocurrencies, often referred to as altcoins, have been developed, each with its own unique features and purposes.

Cryptocurrencies can be used for various purposes, including online purchases, investment, remittances, and as a means of transferring value across borders quickly and with lower fees compared to traditional banking systems. Transactions in cryptocurrencies are typically conducted peer-to-peer, meaning they occur directly between users without the need for intermediaries like banks.

Key features of cryptocurrencies include decentralization, transparency, security, and immutability. Decentralization means that transactions are verified and recorded on a distributed network of computers rather than being controlled by a single entity. Transparency refers to the public nature of blockchain transactions, where anyone can view transaction details. Security is ensured through cryptographic techniques that protect the integrity and confidentiality of transactions. Immutability means that once a transaction is recorded on the blockchain, it cannot be altered or reversed.

Overall, cryptocurrencies represent a new form of digital asset with the potential to revolutionize finance and various other industries by offering secure, efficient, and decentralized means of transferring value and conducting transactions.

Related Work:

❖ Predicting Cryptocurrency Prices using Twitter Sentiment Analysis:

- Journal: 2021 IEEE 4th International Conference on Information Systems and Computer Aided Education (ISCAE)

❖ **Bitcoin Price Prediction through Machine Learning Analysis:**

- Book: Advances in Machine Learning and Data Science
- Publisher: Springer Nature Switzerland

Problem Statement:

Crypto price volatility, fueled by unpredictable factors like policy shifts, tech advancements, and global economic swings, makes trading and investing risky. Current analysis tools struggle to capture these dynamic trends. To empower stakeholders with informed decisions, advanced price prediction strategies and models are desperately needed.

This project explores the crypto market, analyzing historical data and trends to predict future prices. Using technical & fundamental analysis, we'll build models to forecast potential price movements. By providing accurate predictions, we aim to empower investors and traders in this complex market

Inputs and Outputs

Inputs:

Market data:

- Cryptocurrency prices (such as Bitcoin, Ethereum, and others) over time.
- Past trading volumes and transactions.
- Time-based data such as the specific time periods for analysis (daily, weekly, monthly).
- Public market data and market news.
- Economic and political events.
- Volatility in the general market

Outputs:

Market analysis:

- Reports and charts of trends and changes in prices.
- Statistical results and information that have been acquired from data analysis.

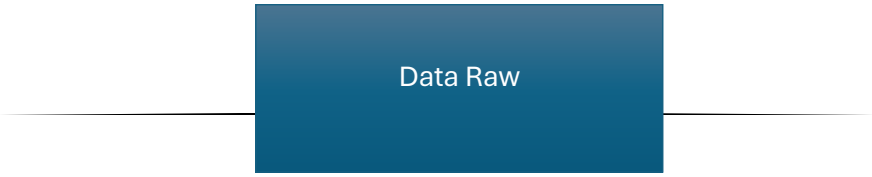
Price predictions:

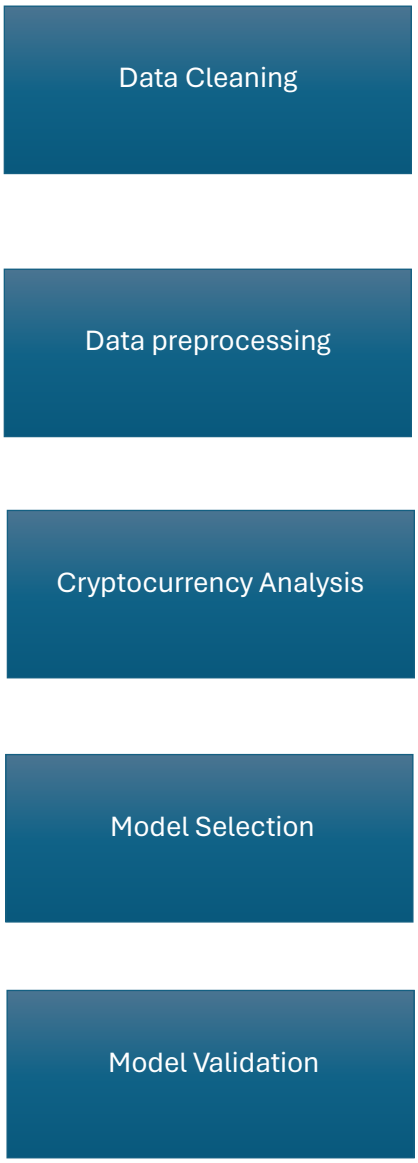
- Predictions for prices in the future based on the predictive models used.

Reports and recommendations:

- Detailed reports that explain the reasons, analyses, and recommendations derived from the results.

Methodology





- **Data Raw:** Raw data is the information collected directly from its sources without any modification or processing. This data serves as the fundamental basis for subsequent data analysis and processing.

- **Data Cleaning**: Data cleaning is the process of correcting or removing incorrect, corrupted, duplicate, or incomplete data from a dataset to ensure that the data is accurate, reliable, and usable for analysis. It is a critical step in any data-related project, including data analysis and data management. This process involves a series of tasks and procedures aimed at improving data quality

- **Data preprocessing**: Data preprocessing is a crucial step in the data analysis and machine learning pipeline. It involves transforming raw data into a clean, usable format suitable for analysis. This step ensures that the data is consistent, accurate, and ready for further processing.

- **Data preprocessing:** Data preprocessing is a vital step in the data analysis and machine learning pipeline. It involves transforming raw data into a clean and usable format, making it suitable for further analysis and modeling.

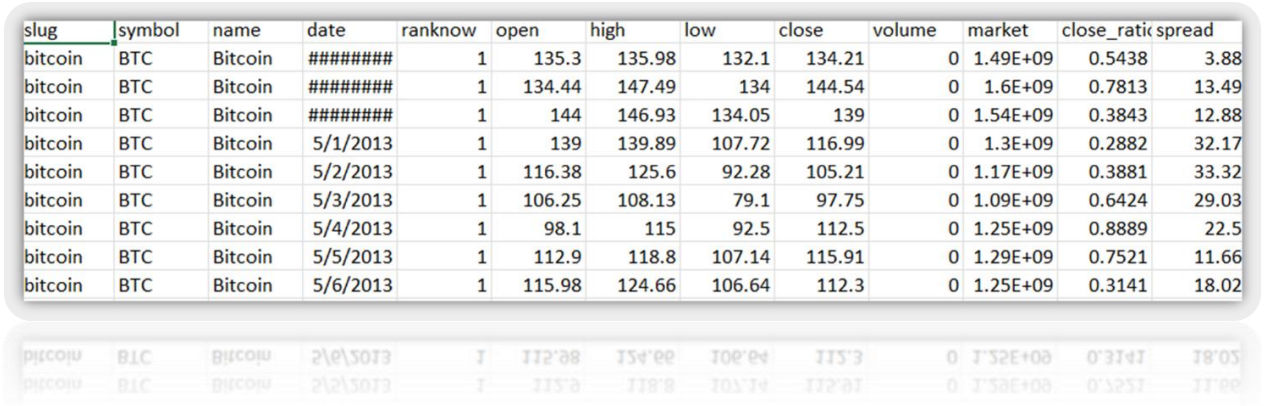
- **Cryptocurrency Analysis**: Cryptocurrency analysis is a multifaceted approach that combines fundamental, technical, and sentiment analysis to provide a comprehensive understanding of the market. By leveraging these methods, investors and traders can make informed decisions, manage risks, and identify potential opportunities in the dynamic and often volatile cryptocurrency market.

- **Model Selection:** Model selection is a critical step in the machine learning pipeline, where the goal is to choose the best model from a set of candidate models for a given dataset and task. This process involves evaluating different models based on their performance, complexity, and suitability for the specific problem at hand

- **Model Validation:** Model validation is a crucial step in the machine learning pipeline that ensures the reliability and generalization capability of a trained model. It involves assessing how well the model performs on unseen data, which is essential for estimating its real-world performance.

Implementation

Data Raw:



slug	symbol	name	date	ranknow	open	high	low	close	volume	market	close_ratio	spread
bitcoin	BTC	Bitcoin	########	1	135.3	135.98	132.1	134.21	0	1.49E+09	0.5438	3.88
bitcoin	BTC	Bitcoin	########	1	134.44	147.49	134	144.54	0	1.6E+09	0.7813	13.49
bitcoin	BTC	Bitcoin	########	1	144	146.93	134.05	139	0	1.54E+09	0.3843	12.88
bitcoin	BTC	Bitcoin	5/1/2013	1	139	139.89	107.72	116.99	0	1.3E+09	0.2882	32.17
bitcoin	BTC	Bitcoin	5/2/2013	1	116.38	125.6	92.28	105.21	0	1.17E+09	0.3881	33.32
bitcoin	BTC	Bitcoin	5/3/2013	1	106.25	108.13	79.1	97.75	0	1.09E+09	0.6424	29.03
bitcoin	BTC	Bitcoin	5/4/2013	1	98.1	115	92.5	112.5	0	1.25E+09	0.8889	22.5
bitcoin	BTC	Bitcoin	5/5/2013	1	112.9	118.8	107.14	115.91	0	1.29E+09	0.7521	11.66
bitcoin	BTC	Bitcoin	5/6/2013	1	115.98	124.66	106.64	112.3	0	1.25E+09	0.3141	18.02

❖ Details:

1. Observations : 942,297 :

   The number of observations in the dataset is 942,297. This means there are 942,297 rows or units of data in the dataset.

2. Variables : 13 :

   The dataset has 13 variables. This means each observation has 13 different types of information or attributes.

3. Crypto : 2,071 :

The dataset has 13 columns, which matches the number of variables mentioned in the second point. This indicates there are 13 attributes or types of data for each observation.

4. Columns: 13:

The dataset has 13 columns, which matches the number of variables mentioned in the second point. This indicates there are 13 attributes or types of data for each observation.

5. Rows: 642268:

The number of rows in the dataset is 642,268. This represents the number of units or observations in the dataset. Note that this number is different from the one mentioned in the first point (942,297), which might indicate an error or that the data is divided into different subsets.

Data Raw:

slug	symbol	name	date	ranknow	open	high	low	close	volume	market	close_ratio	spread

- **Slug:** is the unique symbol for each crypto, introduced to fix duplicate coins sharing Symbol or name
- **Historical:** open, high, low, close values for each crypto from 2013-04-28 to 2018-11-30
- **Ranknow: is** the ranking of all currencies based on its market cap at 2018-11-30
- **volume**: is trading volume of one currency
- **market:** is the total market size = units * USD price per unit of currency
- **close ratio:** (Close-Low)/(High-Low)
- **Spread**: (Close-Low)/Close (I modified by dividing Close to scale the wide range of different prices)

Data Cleaning:

Data cleaning is performed at multiple points in the code. Here are some instances of data cleaning:

```
crypto = crypto.replace([np.inf, -np.inf, np.nan], 0)
```

Handling Missing Data: This line replaces infinite values and NaN (Not a Number) with 0

```
crypto2017 = crypto2017[crypto2017['market'] > 0]
```

Filtering Data: This line filters the crypto2017 Data Frame to exclude rows where the 'market' column is equal to or less than 0.

```
# problem when market = 0
# slug : veritaseum
# date : 2017-6-11
# crypto2017[crypto2017.slug == "veritaseum"].head()
crypto2017 = crypto2017[crypto2017['market'] > 0]
```

Handling Specific Data Issue: This code snippet addresses a specific issue where the 'market' value is 0 for a particular cryptocurrency ('veritaseum') on a specific date ('2017-6-11'). Rows related to this issue are filtered out.

```
df.dropna(inplace=True)
```

Dropping NaN Values: This line drops rows containing NaN values in the resulting DataFrame df

```
crypto_snap = crypto[crypto.date == datetime(2018, 11, 29)]
```

Handling DateTime Filtering: This line filters the crypto DataFrame to include only rows with the date '2018-11-29'.

Data Preprocessing:

In the provided code, feature preprocessing 2 steps include:

❖ **Logarithmic Transformation:**

- Transforming numerical columns like 'close', 'volume', 'market' into their

logarithmic equivalents: 'log_close', 'log_volume', 'log_market'.

- Calculating the spread as (high - low) / close.
- Computing log return as the logarithm of the ratio between close price and the previous day's close.

❖ **Scaling Data:**

Using scale from sklearn.preprocessing to standardize the data: data = scale(df100)

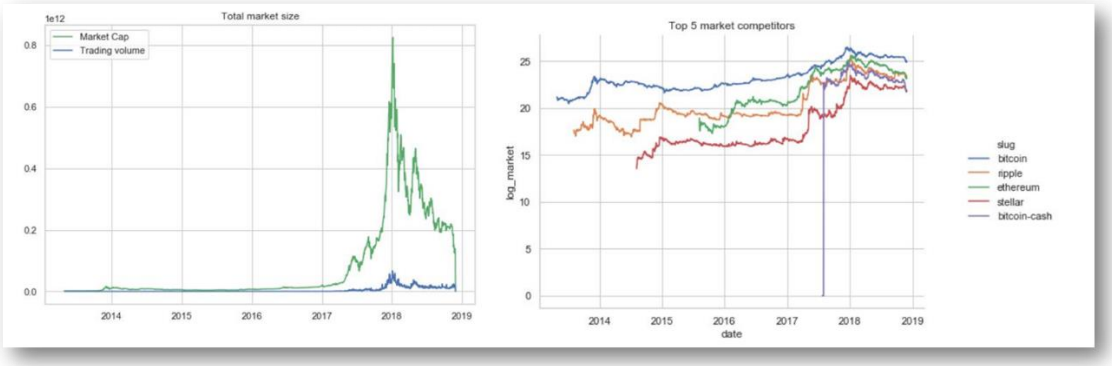
Cryptocurrency Analysis:

➢ Emerging of crypto currencies market:

The emerging of cryptocurrency market can be visualized (with seaborn line plot) by plotting trading volume, market cap over time. We can see

three stages of development, the market comes into existence in 2013, booms in late 2017, with

market size almost reaching 1 trillion, then followed by a crash during first half of 2018 up to now



- Leading market competitors:

Selecting the top 5 cryptos by 'Ranknow', then plot their market

size over time. We can see the dynamics: top 5 competitors are relatively stable over time. They

emerge from earlier 2014 to 2017. Bitcoin is leading the market, ripple recently surpasses

Ethereum to be at the second place.

Models:

➢ K-Means Clustering:

Unsupervised learning algorithm for grouping similar data points into clusters.

Used in the code to identify groups of cryptocurrencies with similar characteristics.

➢ Principal Component Analysis (PCA):

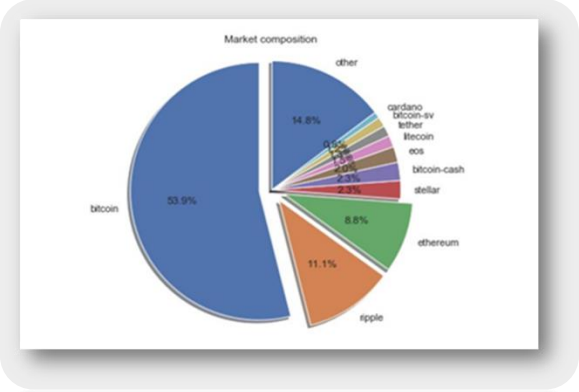
Principal Component Analysis is a technique for dimensionality reduction, where a set of existing variables is transformed into a new set of variables (principal components) while preserving the maximum variance in the original data. PCA is used to simplify data and reduce complexity, making analysis and understanding processes easier. It is widely used in fields such as machine learning and data exploration.

Results:

1. The market in late 2017, with the market size reaching nearly a trillion dollars. This was followed by a downturn in the first half of 2018 up to the present.

2. Bitcoin is leading the market, ripple recently surpasses Ethereum to be at the second place.

3. Top best cryptos compromise 85% of the total market:
    - Bitcoin
    - Ripple
    - Ethereum
    - stellar



Future Work:

- **Web Application**

The idea was determined that the website would be available to the user, and this would be done through well-known web languages such as HTML, CSS

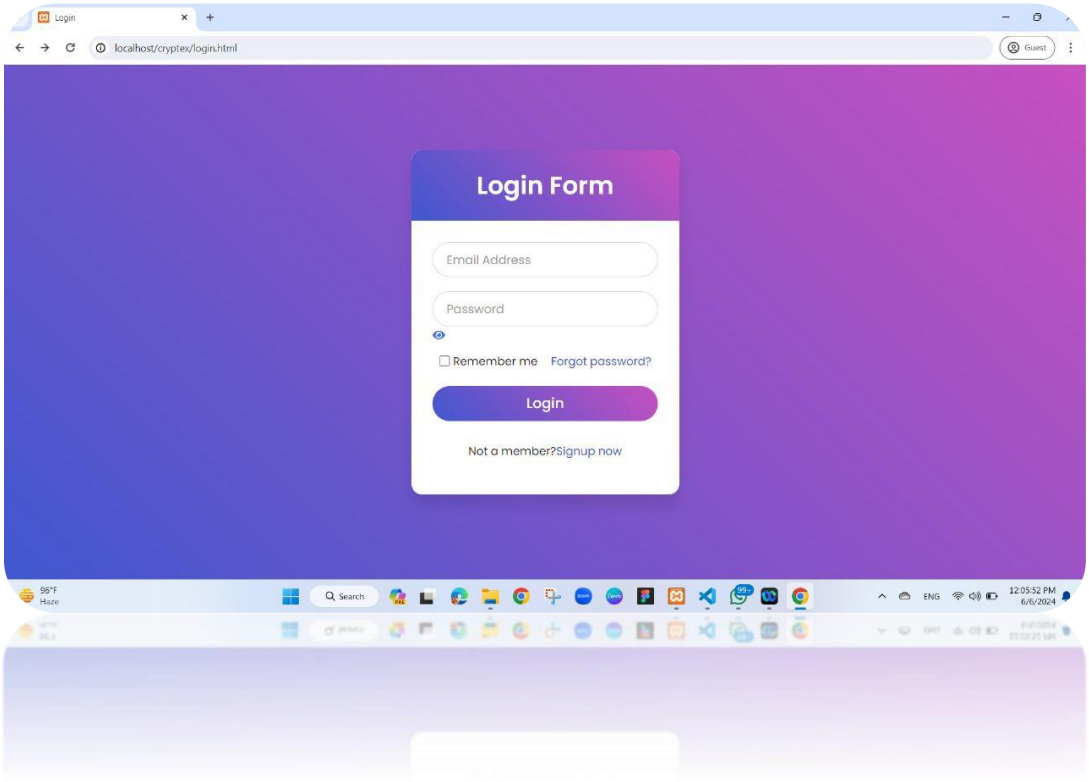
and The document displays Cryptocurrency and reports to the user and will also be added
price prediction

Tools and Technologies:

1. Google Colab
2. Python

Web Application

Log_in:



We've designed a login interface for the website using HTML, CSS, and JavaScript to ensure the security and safety of anyone accessing the site. Users are required to fill in two fields:

1. Email Address
2. Password

This is necessary in case the user is a returning visitor to the website

Attached is the code for that

cryptex > login.html > ...

```html
<!DOCTYPE html>
<html lang="en" dir="ltr">

<head>
    <meta charset="utf-8">
    <title>Login</title>
    <link rel="stylesheet" href="style.css">
    <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/5.15.4/css/all.min.css">
</head>

<body>
    <div class="wrapper">
        <div class="title">
            Login Form
        </div>
        <form action="index.html">
            <div class="field">
                <input type="text" required>
                <label>Email Address</label>
            </div>
            <div class="field">
                <input type="password" id="password" required>
                <label>Password</label>
                <span class="toggle-password" onclick="togglePasswordVisibility()"><i class="fas fa-eye"></i></span>
            </div>
            <br>
            <div class="content">
                <div class="checkbox">
                    <input type="checkbox" id="remember-me">
                    <label for="remember-me">Remember me</label>
                </div>
                <div class="pass-link">
                    <a href="Registration.html">Forgot password?</a>
                </div>
            </div>
            <div class="field">
                <input type="submit" value="Login">
            </div>
            <div class="signup-link">
                Not a member?<a href="Registration.html">Signup now</a>
            </div>
        </form>

    </div>

    <script>
        function togglePasswordVisibility() {
            var x = document.getElementById("password");
            if (x.type === "password") {
                x.type = "text";
            } else {
                x.type = "password";
            }
        }
    </script>

</body>

</html>

```

The code is an HTML page containing a login form. Here's a breakdown of the different parts of the code:

`<!DOCTYPE html>` : This declares the document type and specifies that it's an HTML5 document.

`<html lang="en" dir="ltr">` : This is the opening tag for the HTML document. `lang="en"` specifies the language as English, and `dir="ltr"` specifies the text direction as left-to-right.

`<head>` : This section contains metadata, stylesheets, and browser control.

- `<meta charset="utf-8">` : Specifies the character encoding for the document as UTF-8.
- `<title>Login</title>` : Sets the title of the webpage that appears in the browser's title bar.
- `<link rel="stylesheet" href="style.css">` : Links an external CSS file for styling the page.

- `<link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/5.15.4/css/all.min.css">` : Links the Font Awesome library for using icons.

`<body>` : This section contains the content of the webpage.

- `<div class="wrapper">` : Contains all the content of the page.
- `<div class="title">` : Displays the title of the page as "Login Form".
- `<form action="index.html">` : Defines a form for user input, with its action attribute pointing to "index.html" upon submission.

- `<div class="field">` : Input fields for email and password.
- `<input type="text" required>` : Text input field for email.

- `<input type="password" id="password" required>` : Password input field with a toggle button for visibility.

- `<span class="toggle-password" onclick="togglePasswordVisibility()">...` : Button to toggle password visibility.

- `<div class="content">` : Contains a checkbox for remembering user login and a link for forgotten passwords.

- `<div class="checkbox">` : Checkbox for "Remember me".

- `<div class="pass-link">` : Link for "Forgot password?".

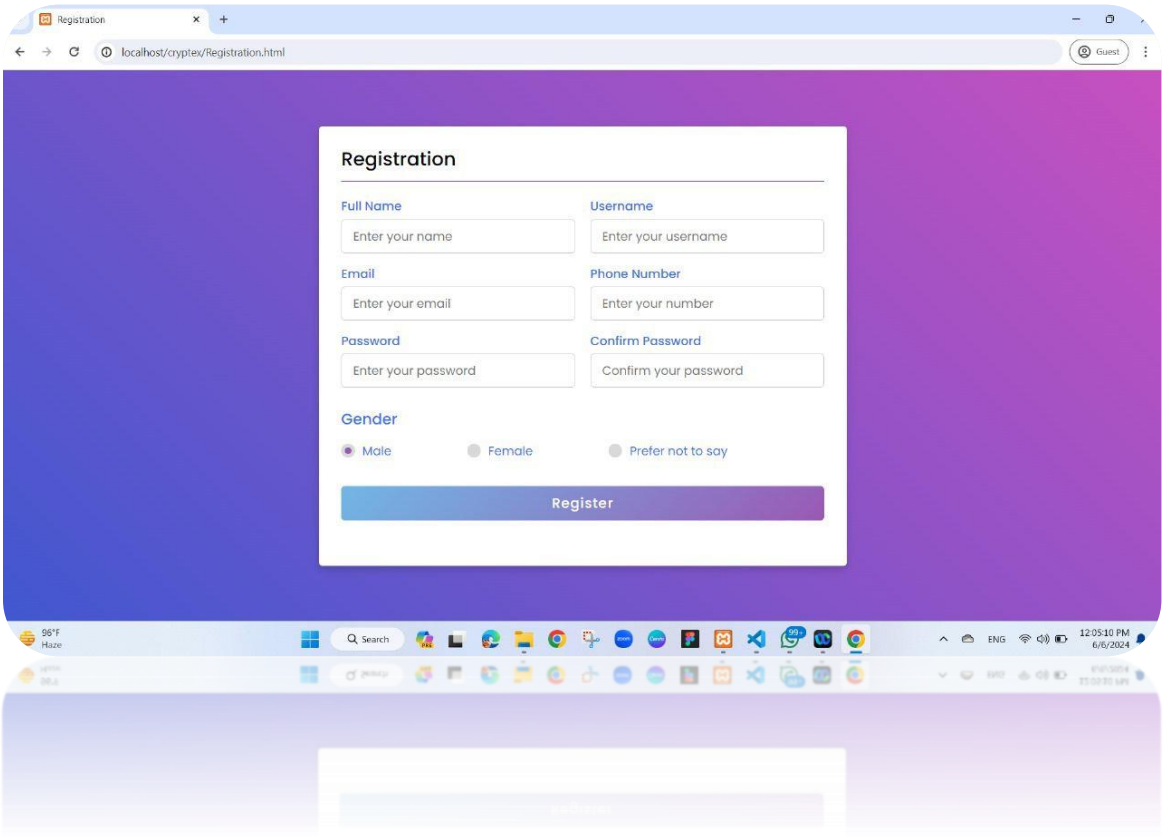
- `<div class="field">` : Input field for the "Login" button.

- `<div class="signup-link">` : Link for signing up if the user doesn't have an account yet.

`<script>` : Contains JavaScript code to toggle password visibility.

- `function togglePasswordVisibility() {...}` : JavaScript function to toggle the password input field between "password" and "text" types when the eye icon is clicked.

Registration:



This window allows the new user to create his own account when entering the site for the first time by registering:

- Full Name
- Email
- password
- username
- phone number
- Confirm the password

Attached is the code for that

```html
<!DOCTYPE html>
<html lang="en" dir="ltr">
  <head>
    <meta charset="UTF-8">
    <title>  Registration </title>
    <link rel="stylesheet" href="style.css">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
  </head>
<body>
  <div class="container">
    <div class="title">Registration</div>
    <div class="content">
      <form action="#">
        <div class="user-details">
          <div class="input-box">
            <span class="details">Full Name</span>
            <input type="text" placeholder="Enter your name" required>
          </div>
          <div class="input-box">
            <span class="details">Username</span>
            <input type="text" placeholder="Enter your username" required>
          </div>
          <div class="input-box">
            <span class="details">Email</span>
            <input type="text" placeholder="Enter your email" required>
          </div>
          <div class="input-box">
            <span class="details">Phone Number</span>
            <input type="text" placeholder="Enter your number" required>
          </div>
          <div class="input-box">
            <span class="details">Password</span>
            <input type="text" placeholder="Enter your password" required>
          </div>
          <div class="input-box">
            <span class="details">Confirm Password</span>
            <input type="text" placeholder="Confirm your password" required>
          </div>
        </div>
        <div class="gender-details">
          <input type="radio" name="gender" id="dot-1">
          <input type="radio" name="gender" id="dot-2">
          <input type="radio" name="gender" id="dot-3">
          <span class="gender-title">Gender</span>
          <div class="category">
            <label for="dot-1">
            <span class="dot one"></span>
            <span class="gender">Male</span>
          </label>
          <label for="dot-2">
            <span class="dot two"></span>
            <span class="gender">Female</span>
          </label>
          <label for="dot-3">
            <span class="dot three"></span>
            <span class="gender">Prefer not to say</span>
            </label>
          </div>
        </div>
        <div class="button">
          <input type="submit" value="Register">
        </div>
      </form>
    </div>
  </div>

</body>
</html>
```

. Let me explain each part of the code:

1. `<!DOCTYPE html>`: Specifies the document type as HTML5.

2. `<html lang="en" dir="ltr">`: This declares the HTML document and sets the language to English, with the text direction set as left-to-right.

3. `<head>`: Contains metadata, including the character set, title, stylesheets, and viewport settings for responsive design.

- `<meta charset="UTF-8">`: Sets the character encoding for the document to UTF-8.
- `<title>Registration</title>`: Sets the title of the webpage to "Registration".
- `<link rel="stylesheet" href="style.css">`: Links an external CSS file for styling the page.
- `<meta name="viewport" content="width=device-width, initial-scale=1.0">`: Sets the viewport to the width of the device and initial zoom level.

4. `<body>`: Contains the content of the webpage.

- `<div class="container">`: Wraps all the content of the page.
- `<div class="title">Registration</div>`: Displays the title of the form as "Registration".
- `<div class="content">`: Contains the form elements.
- `<form action="#">`: The form element with the action attribute set to "#" (a placeholder) for form submission.

- `<div class="user-details">`: Contains input fields for user details such as full name, username, email, phone number, password, and confirm password.

- `<div class="gender-details">`: Contains radio buttons for selecting gender.

- `<div class="button">`: Contains the submit button for registering.

5. `</body>` and `</html>`: End of the HTML page.

Home_page:


Cryptocurrency Price Prediction
Comprehensive cryptocurrency forecasts and market insights for 2024 and beyond
Get started now
BUY
NFT
Crypto Trends
Bitcoin BTC/USD
USD 60,168.95
60,641.20 -0.79%
Ethereum ETH/USD
USD 3,000.04
2,950.20 +10.55%
Tether USDT/USD
USD 1.00
1.01 -0.01%
BNB BNB/USD
USD 443.56
641.20 -1.24%
Market Update
Name Last Price 24h % Market Cap Last 7 Days
1 Bitcoin (BTC) $69595.00 -0.30% $1,371,263,665,270 $-4,663,363,764,851
2 Ethereum (ETH) $3674.10 -0.92% $441,402,568,443 $-3,757,351,600,596
3 Tether (USDT) $1.00 -0.06% $112,411,449,090 $-40,298,756,722
4 BNB (BNB) $648.96 -4.32% $99,932,580,969 $-4,474,675,338,505
5 Solana (SOL) $160.75 -1.26% $74,160,639,111 $-674,240,670,615
6 Lido Staked Ether (STETH) $3672.69 -0.90% $34,922,117,888 $-337,586,312,267
7 USDC (USDC) $1.00 -0.12% $32,069,794,275 $-147,469,053,059
8 XRP (XRP) $0.50 -0.10% $27,617,306,004 $45,710,627

The home page is designed to be simple for the user and it shows the most famous cryptocurrencies and also shows the currency market and updates on the currency in addition to the latest price and its price for the entire market and also the highest price of the currency and the percentage of the currency in the last 24 hours, using a special abi from Google in order to follow updates on the site.

Attached is the code for that

cryptex > index.html > html > body > header.header > div.container > nav.navbar > ul.navbar-list

```html
<!DOCTYPE html>
<html lang="en">

<head>
  <meta charset="UTF-8">
  <meta http-equiv="X-UA-Compatible" content="IE=edge">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Cryptex</title>

  <!--
    - favicon
  -->
  <link rel="shortcut icon" href="./favicon.svg" type="image/svg+xml">

  <!--
    - custom css link
  -->
  <link rel="stylesheet" href="./assets/css/style.css">

  <!--
    - google font link
  -->
  <link rel="preconnect" href="https://fonts.googleapis.com">
  <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
  <link href="https://fonts.googleapis.com/css2?family=DM+Sans:wght@400;500;700&display=swap" rel="stylesheet">

  <style>

    .table-data.green {
      color: green;
    }

    .table-data.red {
      color: red;
    }
</style>
</head>

<body>

  <!--
    - #HEADER
  -->

  <header class="header" data-header>
    <div class="container">

      <a href="#" class="logo">
        <img src="./assets/images/logo.svg" width="32" height="32" alt="Cryptex logo">
        Cryptex
      </a>

      <nav class="navbar" data-navbar>
        <ul class="navbar-list">

          <li class="navbar-item">
            <a href="index.html" class="navbar-link active" data-nav-link>Homepage</a>
          </li>

          <li class="navbar-item">
            <a href="about_us.html" class="navbar-link" data-nav-link>About</a>
          </li>

          <li class="navbar-item">
            <a href="#" class="navbar-link" data-nav-link>Contact Us</a>
          </li>

        </ul>
      </nav>

      <button class="nav-toggle-btn" aria-label="Toggle menu" data-nav-toggler>
        <span class="line line-1"></span>
        <span class="line line-2"></span>
        <span class="line line-3"></span>
      </button>

      <a href="login.html" class="btn btn-outline">Join</a>

    </div>
  </header>

  <main>
    <article>

      <!--
        - #HERO
```

```
    -->

    <section class="section hero" aria-label="hero" data-section>
      <div class="container">

        <div class="hero-content">

          <h1 class="h1 hero-title">Cryptocurrency Price Prediction</h1>

          <p class="hero-text">
            Comprehensive cryptocurrency forecasts and market insights for 2024 and beyond
          </p>

          <a href="#" class="btn btn-primary">Get started now</a>

        </div>

        <figure class="hero-banner">
          <img src="./assets/images/hero-banner.png" width="570" height="448" alt="hero banner" class="w-100">
        </figure>

      </div>
    </section>

    <!--
      - #TREND
    -->

    <section class="section trend" aria-label="crypto trend" data-section>
      <div class="container">

        <div class="trend-tab">

          <ul class="tab-nav">

            <li>
              <button class="tab-btn active">Crypto Trends</button>
            </li>


          </ul>

          <ul class="tab-content">

            <li>
              <div class="trend-card">

                <div class="card-title-wrapper">
                  <img src="./assets/images/coin-1.svg" width="24" height="24" alt="bitcoin logo">

                  <a href="#" class="card-title">
                    Bitcoin <span class="span">BTC/USD</span>
                  </a>
                </div>

                <data class="card-value" value="46168.95">USD 60,168.95</data>

                <div class="card-analytics">
                  <data class="current-price" value="36641.28">60,641.28</data>

                  <div class="badge red">-0.79%</div>
                </div>

              </div>
            </li>

            <li>
              <div class="trend-card active">

                <div class="card-title-wrapper">
                  <img src="./assets/images/coin-2.svg" width="24" height="24" alt="ethereum logo">

                  <a href="#" class="card-title">
                    Ethereum <span class="span">ETH/USD</span>
                  </a>
                </div>

                <data class="card-value" value="3480.84">USD 3,000.84</data>

                <div class="card-analytics">
                  <data class="current-price" value="36641.28">2,950.28</data>

```

```
            </div>
          </li>

          <li>
            <div class="trend-card">

              <div class="card-title-wrapper">
                <img src="./assets/images/coin-3.svg" width="24" height="24" alt="tether logo">

                <a href="#" class="card-title">
                  Tether <span class="span">USDT/USD</span>
                </a>
              </div>

              <data class="card-value" value="1.00">USD 1.00</data>

              <div class="card-analytics">
                <data class="current-price" value="36641.20">1.01</data>

                <div class="badge red">-0.01%</div>
              </div>

            </div>
          </li>

          <li>
            <div class="trend-card">

              <div class="card-title-wrapper">
                <img src="./assets/images/coin-4.svg" width="24" height="24" alt="bnb logo">

                <a href="#" class="card-title">
                  BNB <span class="span">BNB/USD</span>
                </a>
              </div>

              <data class="card-value" value="443.56">USD 443.56</data>

              <div class="card-analytics">
                <data class="current-price" value="36641.20">641.20</data>

                <div class="badge red">-1.24%</div>
              </div>

            </div>
          </li>

        </ul>

      </div>

    </div>
  </section>
  <!--
    - #MARKET
  -->

<section class="section market" aria-label="market update" data-section>
  <div class="container">
    <div class="title-wrapper">
      <h2 class="h2 section-title">Market Update</h2>
      <!--  <a href="#" class="btn-link">See All Coins</a> -->
    </div>

    <table class="market-table">
      <thead class="table-head">
        <tr class="table-row table-title">
          <th class="table-heading" scope="col">#</th>
          <th class="table-heading" scope="col">Name</th>
          <th class="table-heading" scope="col">Last Price</th>
          <th class="table-heading" scope="col">24h %</th>
          <th class="table-heading" scope="col">Market Cap</th>
          <th class="table-heading" scope="col">Last 7 Days</th>
        </tr>
      </thead>
      <tbody id="market-data" class="table-body">
        <!-- Data will be dynamically added here -->
      </tbody>
    </table>
  </div>
```

```
</section>

    <!--
      - #INSTRUCTION
    -->

    <section class="section instruction" aria-label="instruction" data-section>
      <div class="container">

        <h2 class="h2 section-title">How to predict crypto prices? </h2>

        <p class="section-text">
          We use technical indicators to make cryptocurrency price predictions and estimate cryptocurrency prices in the future. </p>

        <ul class="instruction-list">

          <li>
            <div class="instruction-card">

              <figure class="card-banner">
                <img src="./assets/images/instruction-1.png" width="96" height="96" loading="lazy" alt="Step 1"
                  class="img">
              </figure>

              <p class="card-subtitle">Step 1</p>

              <h3 class="h3 card-title">Understanding Technical Indicators</h3>

              <p class="card-text">
                Become familiar with various technical indicators used to predict crypto prices. Stay updated with crypto news to grasp the latest market developments.
              </p>

            </div>
          </li>

          <li>
            <div class="instruction-card">

              <figure class="card-banner">
                <img src="./assets/images/instruction-2.png" width="96" height="96" loading="lazy" alt="Step 2"
                  class="img">
              </figure>

              <p class="card-subtitle">Step 2</p>

              <h3 class="h3 card-title">Analyzing Price Movements</h3>

              <p class="card-text">
                Learn how to read crypto price charts and forecast price movements using technical indicators. Determine whether a cryptocurrency is currently overvalued or undervalued. </p>

            </div>
          </li>

          <li>
            <div class="instruction-card">

              <figure class="card-banner">
                <img src="./assets/images/instruction-3.png" width="96" height="96" loading="lazy" alt="Step 3"
                  class="img">
              </figure>

              <p class="card-subtitle">Step 3</p>

              <h3 class="h3 card-title">Using Moving Averages</h3>

              <p class="card-text">
                Utilize moving averages as a straightforward method for tracking price trends. Gain insights based on whether the asset's price is above or below key moving averages such as the 21-day, 50-day, and 200-day moving averages. </p>

            </div>
          </li>

          <li>
            <div class="instruction-card">

              <figure class="card-banner">
                <img src="./assets/images/instruction-4.png" width="96" height="96" loading="lazy" alt="Step 4"
                  class="img">
              </figure>

              <p class="card-subtitle">Step 4</p>

              <h3 class="h3 card-title">Implementing Support & Resistance Levels</h3>
```

```
            <p class="card-text">
              Identify key support and resistance levels on price charts. These levels can help predict potential price movements and provide entry and exit points for trades. </p>

          </div>
        </li>

      </ul>

    </div>
  </section>



  <!--
    - #ABOUT
  -->

  <section class="section about" aria-label="about" data-section>
    <div class="container">

      <figure class="about-banner">
        <img src="./assets/images/about-banner.png" width="748" height="436" loading="lazy" alt="about banner"
          class="w-100">
      </figure>

      <div class="about-content">

        <h2 class="h2 section-title">What Is Cryptex</h2>

        <p class="section-text">
          Experience a variety of trading on Bitcost. You can use various types of coin transactions such as Spot
          Trade, Futures
          Trade, P2P, Staking, Mining, and margin.
        </p>

        <ul class="section-list">

          <li class="section-item">
            <div class="title-wrapper">
              <ion-icon name="checkmark-circle" aria-hidden="true"></ion-icon>

              <h3 class="h3 list-title">View real-time cryptocurrency prices</h3>
            </div>

            <p class="item-text">
              Experience a variety of trading on Bitcost. You can use various types of coin transactions such as
              Spot Trade, Futures
              Trade, P2P, Staking, Mining, and margin.
            </p>
          </li>

          <li class="section-item">
            <div class="title-wrapper">
              <ion-icon name="checkmark-circle" aria-hidden="true"></ion-icon>

              <h3 class="h3 list-title">Buy and sell BTC, ETH, XRP, OKB, Etc...</h3>
            </div>

            <p class="item-text">
              Experience a variety of trading on Bitcost. You can use various types of coin transactions such as
              Spot Trade, Futures
              Trade, P2P, Staking, Mining, and margin.
            </p>
          </li>

        </ul>

        <a href="#" class="btn btn-primary">Explore More</a>

      </div>

    </div>
  </section>



  <!--
    - #FOOTER
  -->
```

```
      <footer class="footer" data-footer>
        <div class="container">

          <div class="footer-content">

            <div class="footer-section">
              <a href="#" class="logo">
                <img src="./assets/images/logo.svg" width="32" height="32" alt="Cryptex logo">
                Cryptex
              </a>
              <p class="footer-text">
                Predict cryptocurrency prices with confidence using our advanced tools and analysis.
              </p>
            </div>

            <div class="footer-section">
              <h3 class="h3 footer-title">Quick Links</h3>
              <ul class="footer-list">
                <li><a href="#" class="footer-link">Homepage</a></li>
                <li><a href="#" class="footer-link">About</a></li>
                <li><a href="#" class="footer-link">Contact Us</a></li>
              </ul>
            </div>

            <div class="footer-section">
              <h3 class="h3 footer-title">Follow Us</h3>
              <ul class="social-list">
                <li><a href="#" class="social-link"><i class="fab fa-facebook-f"></i></a></li>
                <li><a href="#" class="social-link"><i class="fab fa-twitter"></i></a></li>
                <li><a href="#" class="social-link"><i class="fab fa-instagram"></i></a></li>
                <li><a href="#" class="social-link"><i class="fab fa-linkedin-in"></i></a></li>
              </ul>
            </div>

          </div>

        </div>
      </footer>

    </article>
  </main>



  <script>
// Function to fetch cryptocurrency data from the API
function fetchCryptoData() {
    // Make AJAX request to fetch data
    fetch('https://api.coingecko.com/api/v3/coins/markets?vs_currency=usd')
        .then(response => response.json())
        .then(data => {
            // Process data and update HTML elements
            const marketData = document.getElementById('market-data');
            marketData.innerHTML = ''; // Clear existing data

            // Limit the iteration to the first 16 elements
            data.slice(0, 16).forEach((crypto, index) => {
                const row = `
                    <tr class="table-row">
                        <td class="table-data">${index + 1}</td>
                        <td class="table-data">
                            <img src="${crypto.image}" alt="${crypto.name} logo" width="24" height="24">
                            ${crypto.name} (${crypto.symbol.toUpperCase()})
                        </td>
                        <td class="table-data">$${crypto.current_price.toFixed(2)}</td>
                        <td class="table-data ${crypto.price_change_percentage_24h < 0 ? 'red' : crypto.price_change_percentage_24h > 0 ? 'green' : ''}">
                            ${crypto.price_change_percentage_24h.toFixed(2)}%
                        </td>
                        <td class="table-data">$${crypto.market_cap.toLocaleString()}</td>
                        <td class="table-data">$${crypto.market_cap_change_24h.toLocaleString()}</td>
                    </tr>
                `;
                marketData.innerHTML += row;
            });
        })
        .catch(error => {
            console.error('Error fetching data:', error);
        });
}

// Call the fetchCryptoData function when the page loads
```

This code is an HTML document for a website called "Cryptex" focused on cryptocurrency-related content. Let's break down its components:

1. `<!DOCTYPE html>`: Declares the document type and version of HTML.

2. `<html lang="en">`: Defines the document as using the English language.

3. `<head>`: Contains meta-information about the document and links to external resources.

- `charset="UTF-8"` : Specifies the character encoding of the document as UTF-8.

- `<meta http-equiv="X-UA-Compatible" content="IE=edge">` : Ensures the webpage renders in the highest mode available in Internet Explorer.

- `<meta name="viewport" content="width=device-width, initial-scale=1.0">` : Sets the viewport to the width of the device and initial zoom level.

- `<title>Cryptex</title>` : Sets the title of the webpage.

- `<link rel="shortcut icon" href="./favicon.svg" type="image/svg+xml">` : Links to a favicon for the webpage.

- `<link rel="stylesheet" href="./assets/css/style.css">` : Links to an external CSS file for styling.

- `<link href="https://fonts.googleapis.com/css2?family=DM+Sans:wght@400;500;700&display=swap" rel="stylesheet">` : Links to a Google Font stylesheet to use the font "DM Sans."

4. `<body>` : Contains the content of the webpage.

- `<header>` : Contains the header section with a logo, navigation links, and a join button.

- `<main>` : Contains the main content of the webpage.

- Sections such as hero, crypto trend, market update, instruction, about, and footer are present.

- `<footer>`: Contains the footer section with information about the website, quick links, and social media links.

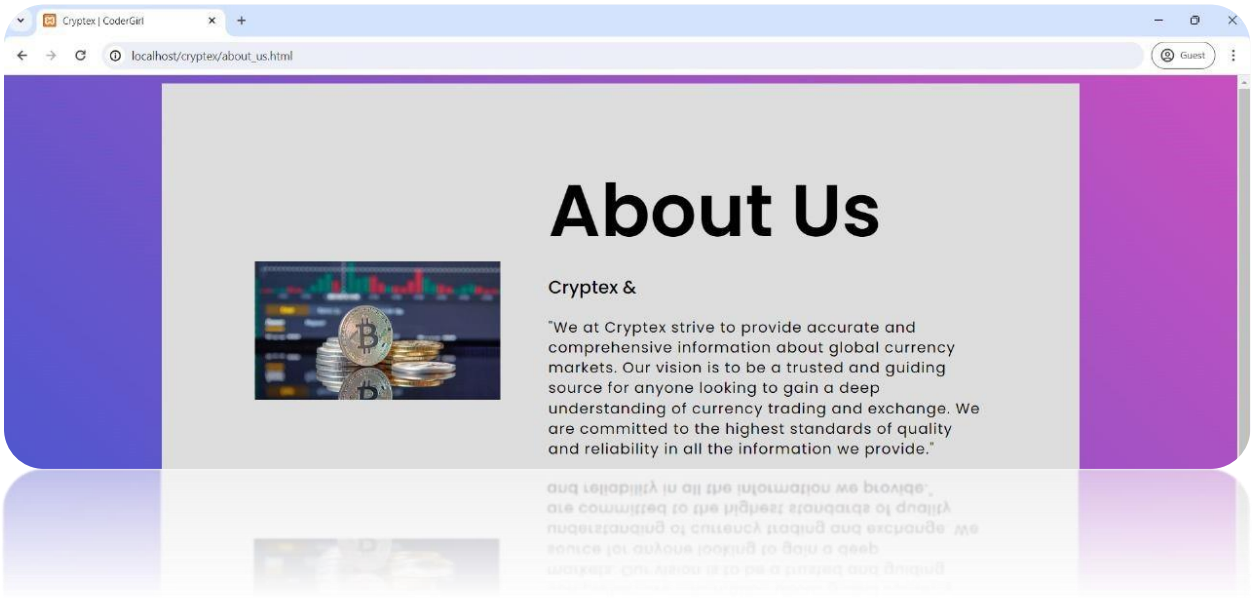
5. `<script>`: Contains JavaScript code for fetching cryptocurrency data from an API and dynamically updating the webpage.

- The `fetchCryptoData()` function fetches data from the CoinGecko API and updates the HTML table with the latest cryptocurrency market data.
- `window.onload = fetchCryptoData;`: Calls the `fetchCryptoData()` function when the page loads.

6. `<script src="https://kit.fontawesome.com/your-fontawesome-kit.js" crossorigin="anonymous"></script>`: Imports Font Awesome icons.

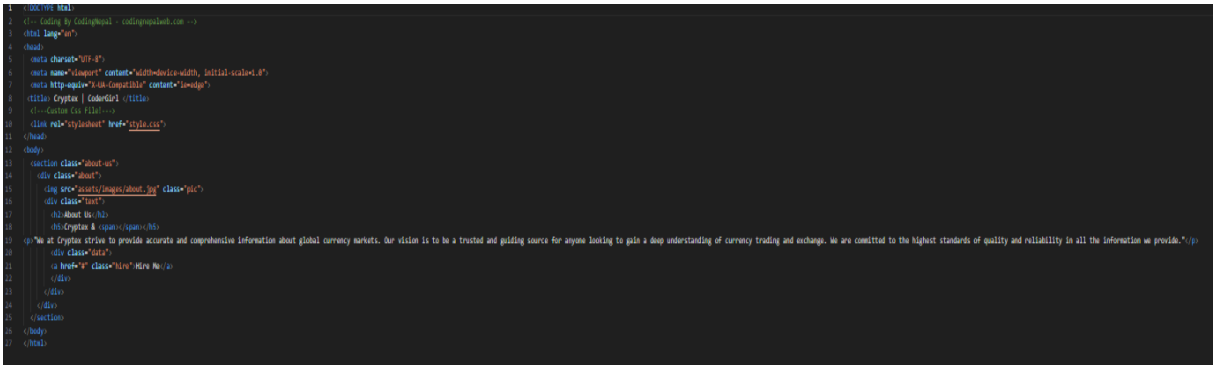
7. `<script src="./assets/js/main.js"></script>`: Links to a custom JavaScript file for additional functionality.

About us _page:



This page talks about the
project in general and what it is, and also tells the user about the site's function and benefit

Attached is the code for that



1. `<!DOCTYPE html>` : Declares the document type and HTML version.

2. `<html lang="en">` : Specifies the document to be in English.

3. `<head>` : Contains descriptive information about the document and links to external resources.

- `charset="UTF-8"` : Specifies the character encoding for the document as UTF-8.

- `<meta name="viewport" content="width=device-width, initial-scale=1.0">` : Sets the viewport width to the device width and initial zoom level to 1.0.

- `<meta http-equiv="X-UA-Compatible" content="ie=edge">` : Specifies a compatible version for the browser engine.

- `<title> Cryptex | CoderGirl </title>` : Sets the page title.

- `<link rel="stylesheet" href="style.css">` : Links to an external CSS file for styling.

4. `<body>` : Contains the page content.

- `<section class="about-us">` : Contains a section about "Cryptex".

- `<div class="about">` : Includes the image and text.

- `<img src="assets/images/about.jpg" class="pic">` : Displays an image representing "Cryptex".

- `<div class="text">` : Contains informational text about "Cryptex".

- `<h2>About Us</h2>` : Section heading.

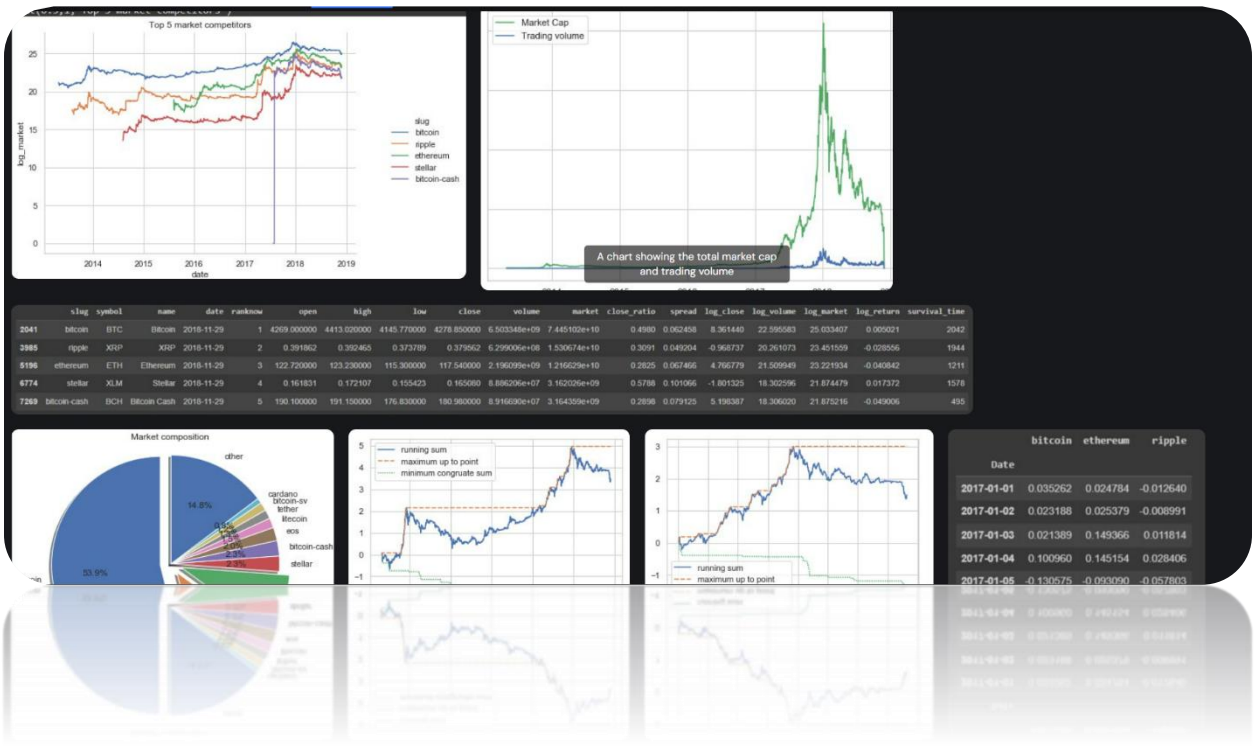
- `<h5>Cryptex & <span></span></h5>` : Subheading.

- `<p>"We at Cryptex ... "</p>` : Text explaining Cryptex's vision and mission.

- `<div class="data">` : Contains a link for hiring.

- `<a href="#" class="hire">Hire Me</a>` : Link for hiring.

Crypto analysis:



In this part, it is the basic science of the site, showing important movements in currencies, for example, the top 5 currencies that were dealt with

Existing and most famous currencies

You can enjoy trading via Google colap, whose code is also attached below

Attached is the code for that

```html
<!DOCTYPE html>
<html lang="en">

<head>
  <meta charset="UTF-8">
  <meta http-equiv="X-UA-Compatible" content="IE=edge">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Cryptex</title>

  <!--
    - favicon
  -->
  <link rel="shortcut icon" href="./favicon.svg" type="image/svg+xml">

  <!--
    - custom css link
  -->
  <link rel="stylesheet" href="./assets/css/style.css">

  <!--
    - google font link
  -->
  <link rel="preconnect" href="https://fonts.googleapis.com">
  <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
  <link href="https://fonts.googleapis.com/css2?family=DM+Sans:wght@400;500;700&display=swap" rel="stylesheet">

  <style>
    .gallery {
      display: flex;
      flex-wrap: wrap;
    }

    .image {
      margin: 10px;
      text-align: center;
      position: relative;
      overflow: hidden;
      border-radius: 10px;
    }

    .image img {
      transition: transform 0.3s ease;
      border-radius: 10px;
      width: 100%;
    }

    .caption {
      margin-top: 5px;
      font-size: 14px;
      opacity: 0;
      transition: opacity 0.3s ease;
      position: absolute;
      bottom: 10px;
      left: 50%;
      transform: translateX(-50%);
      background: rgba(0, 0, 0, 0.6);
      color: white;
      padding: 5px 10px;
      border-radius: 5px;
    }

    .image:hover img {
      transform: scale(1.1);
    }

    .image:hover .caption {
      opacity: 1;
    }
  </style>
</head>

<body>
  <header class="header" data-header>
    <div class="container">
      <a href="#" class="logo">
        <img src="./assets/images/logo.svg" width="32" height="32" alt="Cryptex logo"> Cryptex
      </a>
      <nav class="navbar" data-navbar>
        <ul class="navbar-list">
          <li class="navbar-item">
            <a href="index.html" class="navbar-link active" data-nav-link>Homepage</a>
          </li>
          <li class="navbar-item">
            <a href="about_us.html" class="navbar-link" data-nav-link>About</a>
          </li>
          <li class="navbar-item">
```

```
            <a href="Cryptex.html" class="navbar-link" data-nav-link>Cryptex</a>
          </li>
        </ul>
      </nav>
      <button class="nav-toggle-btn" aria-label="Toggle menu" data-nav-toggler>
        <span class="line line-1"></span>
        <span class="line line-2"></span>
        <span class="line line-3"></span>
      </button>
      <a href="login.html" class="btn btn-outline">Join</a>
    </div>
  </header>
  <br><br>
  <div class="gallery">
    <div class="image image-1">
      <img src="assets/images/1.jpg" alt="Image 1">
      <div class="caption">A cross-chart of the overall market size and play diversity of the crypto market A chart showing the total market cap and trading volume</div>
    </div>
    <div class="image image-2">
      <img src="assets/images/2.jpg" alt="Image 2">
      <div class="caption">A chart showing the total market cap and trading volume</div>
    </div>
    <div class="image image-3">
      <img src="assets/images/3.jpg" alt="Image 3">
      <div class="caption">Showing top 5 cryptocurrencies based on their ranking.</div>
    </div>
    <div class="image image-4">
      <img src="assets/images/4.jpg" alt="Image 4">
      <div class="caption">Showing the market composition of a number of cryptocurrencies The percentages for each cryptocurrency are displayed in pie slices, with larger values representing larger pie slices.</div>
    </div>
    <div class="image image-5">
      <img src="assets/images/5.jpg" alt="Image 5">
      <div class="caption">Bitcoin's maximum drop in price,</div>
    </div>
    <div class="image image-6">
      <img src="assets/images/6.jpg" alt="Image 6">
      <div class="caption">Bitcoin's largest drop in price during a certain period, which is from 2017-01-01 to the present.</div>
    </div>
    <div class="image image-7">
      <img src="assets/images/7.jpg" alt="Image 7">
      <div class="caption">A data frame containing the returns of cryptocurrencies such as Bitcoin, Ethereum, and Ripple for 2017.</div>
    </div>
    <div class="image image-8">
      <img src="assets/images/8.jpg" alt="Image 8">
      <div class="caption">A data frame containing returns for cryptocurrencies and real assets together for dates that match both.</div>
    </div>
    <div class="image image-9">
      <img src="assets/images/9.jpg" alt="Image 9">
      <div class="caption">Calculate some basic statistics for 2017 cryptocurrency returns, such as the mean and standard deviation</div>
    </div>
    <div class="image image-10">
      <img src="assets/images/10.jpg" alt="Image 10">
      <div class="caption">crypto2017.describe</div>
    </div>
  </div>
</body>

</html>
```

The code for each graph is also attached

Attached is the code for that

```
[ ] crypto_3 = crypto[(crypto.ranknow <= 3)]
    crypto_5 = crypto[(crypto.ranknow <= 5)]

    g = sns.relplot(x = 'date', y = 'log_market', kind = 'line', data = crypto_5, hue = 'slug')
    g.fig.set_figwidth(9)
    g.ax.set_title("Top 5 market competitors")

    Text(0.5,1,'Top 5 market competitors')
```

crypto_3: Keeps only the records that are ranked within the top 3 (ranknow <= 3).

crypto_5: Keeps the records that are ranked within the top 5 (ranknow <= 5).

sns.relplot(...): Used to create relational plots in Seaborn.

x = 'date': Specifies that the horizontal axis (x-axis) represents dates.

y = 'log_market': Specifies that the vertical axis (y-axis) represents the log_market value.

kind = 'line': Specifies that the plot type should be a line plot.

data = crypto_5: Uses the crypto_5 data, which contains the top-ranked cryptocurrencies (up to rank 5).

hue = 'slug': Differentiates the lines in the plot based on unique values in the slug column.

g.fig.set_figwidth(9): Sets the figure width to 9 units.

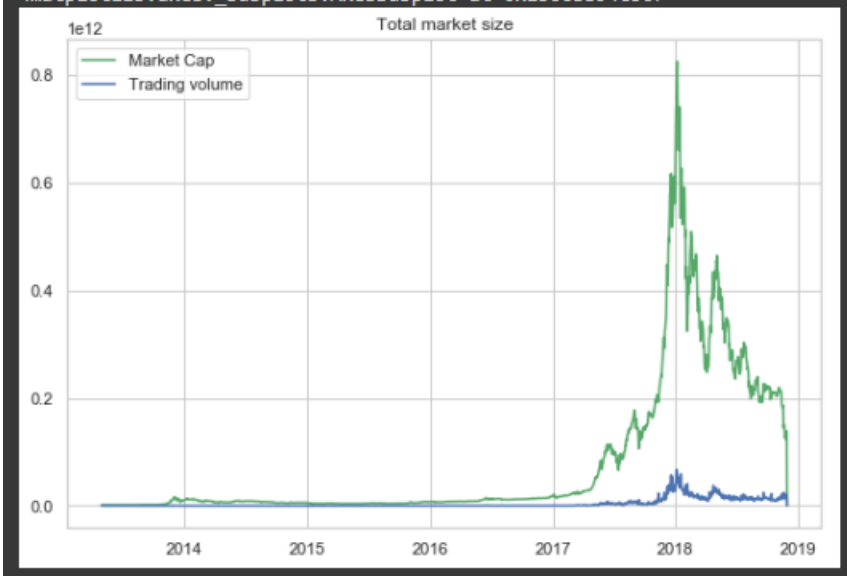
g.ax.set_title("Top 5 market competitors"): Sets the plot title to "Top 5 market competitors".

In summary:

This code filters cryptocurrency data to include only the top 5 cryptocurrencies by current rank, then creates a line plot showing the changes in market value for each cryptocurrency over time, with each cryptocurrency distinguished by a different color.

```
sns.set(style="whitegrid")
fig1, ax1 = plt.subplots(figsize=(9,6))
ax1.set_title('Total market size')
sns.lineplot(data=crypto_market.market, color="g", label='Market Cap')
sns.lineplot(data=crypto_market.volume, color="b", label='Trading volume')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x1306bb94c50>
```



This sets the aesthetic style of the plots to "whitegrid", which adds a white background with gridlines.

fig1, ax1 = plt.subplots(figsize=(9,6)): Creates a figure (fig1) and a set of subplots (ax1) with a specified size of 9x6 inches.

ax1.set_title('Total market size'): Sets the title of the plot to "Total market size".

sns.lineplot(data=crypto_market.market, color="g", label='Market Cap'): Creates a line plot for the market capitalization using data from crypto_market.market, with the line colored green and labeled "Market Cap".

sns.lineplot(data=crypto_market.volume, color="b", label='Trading volume'): Creates a line plot for the trading volume using data from crypto_market.volume, with the line colored blue and labeled "Trading volume".

crypto_3: Filters the crypto DataFrame to include only the records where the ranknow column is less than or equal to 3.

crypto_5: Filters the crypto DataFrame to include only the records where the ranknow column is less than or equal to 5.

g = sns.relplot(x = 'date', y = 'log_market', kind = 'line', data = crypto_5, hue = 'slug'): Creates a relational plot using Seaborn. This plot will show the log market values over time (x = 'date', y = 'log_market') for the top 5 cryptocurrencies (data = crypto_5), with each cryptocurrency differentiated by color (hue = 'slug').

g.fig.set_figwidth(9): Sets the width of the figure to 9 units.

g.ax.set_title("Top 5 market competitors"): Sets the title of the plot to "Top 5 market competitors".

Summary:

- The code sets the style for the plots and creates a figure to visualize the total market size, including market capitalization and trading volume.
- It filters the cryptocurrency data to keep only the top 3 and top 5 ranked cryptocurrencies.
- It then creates a separate plot to show the changes in market value for the top 5 cryptocurrencies over time, with different colors representing different cryptocurrencies.

```
crypto_snap.sort_values('ranknow', ascending=True).head(5)
```

	slug	symbol	name	date	ranknow	open	high	low	close	volume	market	close_ratio	spread	log_close	log_volume	log_market	log_return	survival_time
2041	bitcoin	BTC	Bitcoin	2018-11-29	1	4269.000000	4413.020000	4145.770000	4278.850000	6.503348e+09	7.445102e+10	0.4980	0.062458	8.361440	22.595583	25.033407	0.005021	2042
3985	ripple	XRP	XRP	2018-11-29	2	0.391862	0.392465	0.373789	0.379562	6.299006e+08	1.530674e+10	0.3091	0.049204	-0.968737	20.261073	23.451559	-0.028556	1944
5196	ethereum	ETH	Ethereum	2018-11-29	3	122.720000	123.230000	115.300000	117.540000	2.196099e+09	1.216629e+10	0.2825	0.067466	4.766779	21.509949	23.221934	-0.040842	1211
6774	stellar	XLM	Stellar	2018-11-29	4	0.161831	0.172107	0.155423	0.165080	8.886206e+07	3.162026e+09	0.5788	0.101066	-1.801325	18.302596	21.874479	0.017372	1578
7269	bitcoin-cash	BCH	Bitcoin Cash	2018-11-29	5	190.100000	191.150000	176.830000	180.980000	8.916690e+07	3.164359e+09	0.2898	0.079125	5.198387	18.306020	21.875216	-0.049006	495

The line of code sorts the crypto snap DataFrame by the ranknow column in ascending order, meaning the cryptocurrencies with the lowest (best) rankings will come first.

It then takes the first 5 rows from this sorted DataFrame.

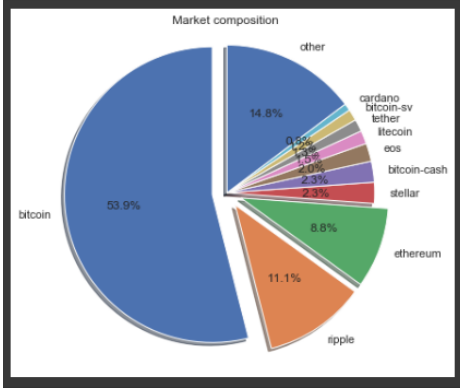
As a result, this code returns the top 5 cryptocurrencies based on their current rank.

```python
# Code reference:
# https://matplotlib.org/gallery/pie_and_polar_charts/pie_features.html#sphx-glr-gallery-pie-and-polar-charts-pie-features-py

# Pie chart, where the slices will be ordered and plotted counter-clockwise:
labels = crypto_snap[crypto_snap.ranknow <= 11].slug.replace('monero', 'other')
sizes = crypto_mkt_comp
explode = (0.1, 0.1, 0.1, 0, 0, 0, 0, 0, 0, 0)  # only "explode" the first 3 slices

fig1, ax1 = plt.subplots(figsize=(6,6))
ax1.set_title('Market composition')
ax1.pie(sizes, explode = explode, labels=labels, autopct='%1.1f%%',
        shadow=True, startangle=90)
ax1.axis('equal')  # Equal aspect ratio ensures that pie is drawn as a circle.

plt.show()
```



This code snippet creates a pie chart showing the market composition of the top 11 cryptocurrencies, with special visual emphasis on the top 3 by "exploding" their slices. It uses labels from the crypto_snap DataFrame, replacing 'monero' with 'other', and it ensures the pie chart is circular and properly labeled with percentages.

```
print("From earliest to now,")
max_drawdown(bitcoin)
```

```
From earliest to now,
Maximum drawdown is -186.62%, from 2013-12-05 to 2015-01-15
```

The max_drawdown function calculates and visualizes the maximum drawdown for Bitcoin's historical data, identifying the largest percentage decline from peak to trough in its value over time.

```
print("From 2017-01-01 to now, ")
max_drawdown(bitcoin[bitcoin.date.dt.year >= 2017])
```

```
From 2017-01-01 to now,
Maximum drawdown is -164.08%, from 2017-12-17 to 2018-11-27
```

The updated code filters the historical Bitcoin data to include only entries from January 1, 2017, onwards and then calculates the maximum drawdown for this period. The function visualizes the running sum, the maximum running sum, and the minimum drawdown, and prints out the maximum drawdown percentage along with the specific time window during which it occurred. This provides insight into the largest peak-to-trough decline in Bitcoin's value since 2017.

```
bitcoin2017 = crypto2017[crypto2017.slug == 'bitcoin']
ethereum2017 = crypto2017[crypto2017.slug == 'ethereum']
ripple2017 = crypto2017[crypto2017.slug == 'ripple']
```

```
virtual_asset = pd.DataFrame(columns =[], index = bitcoin2017.date)
virtual_asset = pd.merge(virtual_asset, bitcoin2017[['date', 'log_return']], how='inner', left_on = 'date', right_on = 'date')
virtual_asset = pd.merge(virtual_asset, ethereum2017[['date', 'log_return']], how='inner', left_on = 'date', right_on = 'date')
virtual_asset = pd.merge(virtual_asset, ripple2017[['date', 'log_return']], how='inner', left_on = 'date', right_on = 'date')
virtual_asset.columns = ['Date','bitcoin', 'ethereum', 'ripple']
```

```
virtual_asset.set_index('Date').head()
```

Date	bitcoin	ethereum	ripple
2017-01-01	0.035262	0.024784	-0.012640
2017-01-02	0.023188	0.025379	-0.008991
2017-01-03	0.021389	0.149366	0.011814
2017-01-04	0.100960	0.145154	0.028406
2017-01-05	-0.130575	-0.093090	-0.057803

The code filters the crypto2017 DataFrame to obtain data for Bitcoin, Ethereum, and Ripple specifically for the year 2017. It then creates an empty DataFrame indexed by dates from the Bitcoin data and merges it with the log returns of Bitcoin, Ethereum, and Ripple based on their dates. Finally, it renames the columns to make them more readable and sets the 'Date' column as the index before displaying the first few rows of the resulting DataFrame.

The resulting DataFrame virtual_asset contains log returns for Bitcoin, Ethereum, and Ripple for the dates where all three cryptocurrencies have data in 2017. This allows for comparative analysis of their returns during that year.

	Date	bitcoin	ethereum	ripple	Gold_Price	Stock_Index	USD_Index
469	2018-11-23	-0.004322	-0.027281	-0.044763	-0.001513	-0.006576	0.002169
470	2018-11-26	-0.059290	-0.072280	-0.052341	0.003675	0.015413	0.001546
471	2018-11-27	0.010945	0.015389	0.013169	-0.001305	0.003256	0.003086
472	2018-11-28	0.108224	0.107050	0.081017	-0.009720	0.022714	-0.005974
473	2018-11-29	0.005021	-0.040842	-0.028556	0.010862	-0.002185	-0.000103

By merging virtual_asset with real_asset on the 'Date' column, you create a new DataFrame six_assets that contains log returns for both virtual assets (cryptocurrencies) and real assets. Viewing the last few rows with tail() allows you to verify the merged data and ensure that the integration of the two DataFrames was successful.

```
df.sort_values('ranknow').head()
```

slug	ranknow	open	high	low	close	volume	market	close_ratio	spread	log_close	log_volume	log_market	log_return	survival_time	mean	std	skew	kurt
bitcoin	1	5879.437479	6063.117980	5670.512206	5883.713438	4.166287e+09	9.937140e+10	0.560631	0.059213	8.404334	21.547487	25.037688	0.002136	2042	0.002136	0.046586	-0.127863	3.088802
ripple	2	0.438744	0.464717	0.411817	0.439343	5.504764e+08	1.714795e+10	0.493710	0.098064	-1.523831	18.788558	22.854042	0.005838	1944	0.005838	0.094677	2.543051	26.824691
ethereum	3	364.897579	379.184570	348.321017	364.924470	1.472782e+09	3.563600e+10	0.534083	0.079504	5.416638	20.420479	23.797372	0.003855	1211	0.003855	0.064230	0.287972	3.598397
stellar	4	0.160354	0.169826	0.150213	0.160550	6.672434e+07	2.916303e+09	0.499450	0.125605	-2.850370	16.646575	20.518061	0.006021	1578	0.006021	0.099679	1.742224	11.438352
bitcoin-cash	5	931.378230	988.645288	873.769239	930.856481	7.681712e+08	1.582737e+10	0.472779	0.112429	6.648604	20.082223	23.298961	-0.001002	495	-0.001002	0.092247	0.471956	5.545678

- **Sorting:** The DataFrame df is sorted by the 'ranknow' column in ascending order.
- **Displaying:** The head() method is used to display the first 5 rows of the sorted DataFrame.

This is a useful operation when you want to view the top entries in a DataFrame based on a specific ranking or value.

```
crypto2017.describe()
```

	ranknow	open	high	low	close	volume	market	close_ratio	spread	log_close	log_volume	log_market	log_return	survival_time
count	595238.000000	5.952380e+05	5.952380e+05	5.952380e+05	5.952380e+05	5.952380e+05	5.952380e+05	595238.000000	595238.000000	595238.000000	595238.000000	595238.000000	595238.000000	595238.000000
mean	902.305333	4.658370e+02	5.445852e+02	4.007423e+02	4.639630e+02	1.347123e+07	2.577568e+08	0.467447	0.248625	-3.020493	9.517809	14.672578	-0.002463	776.299779
std	543.206972	1.578348e+04	1.930277e+04	1.324945e+04	1.572415e+04	2.312951e+08	4.485329e+09	0.316437	3.771033	3.384964	4.177720	2.816939	0.211420	528.704725
min	1.000000	1.100000e-08	2.400000e-08	5.700000e-09	1.100000e-08	0.000000e+00	3.000000e+00	0.000000	0.000000	-18.325371	0.000000	1.098612	-10.112565	9.000000
25%	403.000000	6.776000e-03	7.601000e-03	6.055000e-03	6.750250e-03	6.990000e+02	3.278428e+05	0.183400	0.089195	-4.998176	6.549651	12.700289	-0.065228	369.000000
50%	915.000000	4.889850e-02	5.420100e-02	4.397100e-02	4.871600e-02	1.650700e+04	2.661575e+06	0.444900	0.155348	-3.021748	9.711540	14.794429	-0.004157	565.000000
75%	1402.000000	3.701320e-01	4.079625e-01	3.352648e-01	3.691550e-01	2.843362e+05	1.561490e+07	0.742100	0.270866	-0.996539	12.557913	16.563736	0.051087	1176.000000
max	2039.000000	2.298390e+06	2.926100e+06	2.030590e+06	2.300740e+06	2.384090e+10	3.265025e+11	1.000000	2430.985612	14.648741	23.894668	26.511703	15.185294	2042.000000

crypto2017.describe() provides a quick overview of the statistical properties of the numerical columns in the DataFrame, aiding in understanding the distribution and characteristics of the data.

References:

- Journal: 2021 IEEE 4th International Conference on Information Systems and Computer:

  - https://www.researchgate.net/publication/369300310_Cryptocurrency_Price_Prediction_using_Twitter_Sentiment_Analysis

- **Publisher:** Springer Nature Switzerland:

  - https://dokumen.pub/smart-trends-in-computing-and-communications-proceedings-of-smartcom-2020-1st-ed-9789811552236-9789811552243.html

Conclusion

The project aims to analyze cryptocurrency trends and predict their prices accurately. Through a comprehensive literature review and the application of various data analysis techniques, the report delves into understanding the dynamics of the cryptocurrency market. Utilizing machine learning algorithms and statistical models, it seeks to develop predictive models capable of forecasting cryptocurrency prices. The report presents the findings of the analysis, including insights into influential factors affecting cryptocurrency prices. Additionally, it discusses the implications of the results and provides recommendations for future research and traders in this field.