Tech Saksham

Capstone Project Report

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING FUNDAMENTALS

EMAIL SPAM DETECTION

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Trainer Name

Master Trainer

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ABSTRACT

Nowadays, a big part of people rely on available email or messages sent by the stranger. The possibility that anybody can leave an email or a message provides a golden opportunity for spammers to write spam message about our different interests .Spam fills inbox with number of ridiculous emails . Degrades our internet speed to a great extent .Steals useful information like our details on our contact list. Identifying these spammers and also the spam content can be a hot topic of research and laborious tasks. Email spam is an operation to send messages in bulk by mail .Since the expense of the spam is borne mostly by the recipient ,it is effectively postage due advertising. Spam email is a kind of commercial advertising which is economically viable because email could be a very cost effective medium for sender .With this proposed model the specified message can be stated as spam or not using Bayes’ theorem and Naive Bayes’ Classifier and Also IP addresses of the sender are often detected .

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CHAPTER 1

INTRODUCTION

Today, Spam has become a major problem in communication over internet. It has been accounted that around 55% of all emails are reported as spam and the number has been growing steadily. Spam which is also known as unsolicited bulk email has led to the increasing use of email as email provides the perfect ways to send the unwanted advertisement or junk newsgroup posting at no cost for the sender. This chances has been extensively exploited by irresponsible organizations and resulting to clutter the mail boxes of millions of people all around the world. Spam has been a major concern given the offensive content of messages, spam is a waste of time. End user is at risk of deleting legitimate mail by mistake. Moreover, spam also impacted the economical which led some countries to adopt legislation. Text classification is used to determine the path of incoming mail/message either into inbox or straight to spam folder. It is the process of assigning categories to text according to its content. It is used to organized, structures and categorize text. It can be done either manually or automatically. Machine learning automatically classifies the text in a much faster way than manual technique. Machine learning uses pre-labelled text to learn the different associations between pieces of text and it output. It used feature extraction to transform each text to numerical representation in form of vector which represents the frequency of word in predefined dictionary. Text classification is important to structure the unstructured and messy nature of text such as documents and spam messages in a cost-effective way. Machine learning can make more accurate precisions in real-time and help to improve the manual slow process to much better and faster analysing big data. It is important especially to a company to analyse text data, help inform business decisions and even automate business processes. In this project, machine learning techniques are used to detect the spam message of a mail. Machine learning is where computers can learn to do something 10 without the need to explicitly program them for the task. It uses data and produce a program to perform a task such as classification. Compared to knowledge engineering, machine learning techniques require messages that have been successfully pre-classified. The pre-classified messages make the training dataset which will be used to fit the learning algorithm to the model in machine learning studio. A combination of algorithms are used to learn the classification rules from messages. These algorithms are used for classification of objects of different classes. These algorithms are provided with pre labelled data and an unknown text. After learning from the prelabelled data each of these algorithms predict which class the unknown text may belong to and the category predicted by majority is considered as final.

1.1 Problem Statement

Unwanted e-mails irritating internet connection

Critical e-mail message are missed and delayed

Millions of compromised computers

It occupies more space in the cloud

Identity theft

Spam can crash mail servers and fil up hard drives

1.2 Proposed Solution

In this system, to solve the problem of spam, the spam classification system is created to identify spam and nonspam. Since spammers may send spam messages many times, it is difficult to identify it every time manually .So we will be using some of the strategies in our proposed system to detect the spam. The proposed solution not only identifies the spam word but also identifies the IP address of the system through which the spam message is sent so that next time when the spam message is sent from the same system our proposed system directly identifies it as blacklisted based on the IP address. In the proposed model ,the web application is done using dot net and spam detection is done using machine learning .The web application consists of following modules:

1.3Feature

Email spam detection relies on a variety of features extracted from email data to distinguish between spam and legitimate messages. These features serve as input variables for machine learning algorithms and statistical models used in spam detection systems. Here are some common features used in email spam detection:

1. **Sender Information**: Characteristics of the email sender, including the sender's email address, domain reputation, sender's IP address, and authentication status (e.g., SPF, DKIM, DMARC). Anomalies or inconsistencies in sender information can indicate potential spam.
2. **Content Analysis**: Analysis of the textual content of the email, including subject line, body text, and embedded links. Features extracted from content analysis may include:
    - Presence of spam-related keywords or phrases (e.g., "free," "discount," "limited time offer").
    - Frequency of certain words or phrases.
    - Use of HTML or rich text formatting.
    - Presence of misspellings, unusual characters, or obfuscation techniques.

3. **Metadata Analysis**: Examination of metadata associated with the email, such as timestamp, message ID, and header information. Metadata features may include:
    - Time of day the email was sent.
    - Geolocation of the sender's IP address.
    - Number of recipients.
    - Email client or software used to send the email.
4. **Structural Analysis**: Analysis of the structural characteristics of the email, including:
    - Number of recipients (to, cc, bcc).
    - Presence of attachments or embedded media files.
    - MIME type of attachments.
    - HTML code analysis for suspicious elements (e.g., hidden text, invisible links).
5. **URL Analysis**: Examination of URLs contained within the email, including:
    - URL length and format.
    - Domain reputation of linked websites.
    - Presence of URL redirects or URL shortening services.
    - Blacklisted or suspicious domains.
6. **Header Analysis**: Inspection of email headers for anomalies or signs of spoofing, including:
    - Consistency between the "From" header and the sender's domain.
    - Presence of additional headers indicating email routing or forwarding.
    - Use of email authentication mechanisms (e.g., SPF, DKIM, DMARC).
7. **Behavioral Analysis**: Analysis of user behavior and interaction patterns with emails, such as:
    - User engagement metrics (e.g., open rate, click-through rate).
    - Frequency of marking emails as spam or moving them to spam folders.
    - Analysis of historical email interactions and user preferences.
8. **Machine Learning-Based Features**: Derived features generated through machine learning algorithms, such as:
    - Predicted probability scores from spam detection models.
    - Feature importance scores indicating the contribution of each feature to the classification decision.
    - Clustering or grouping of emails based on similarity in feature space.

1.4Advantage

- Protection Against Malicious Activities:
- Enhanced Productivity:
- Improved User Experience
- Protection Against Offensive Content
- Reduced Risk of Security Breaches
- Preservation of Network Bandwidth
- Compliance with Regulations:
- Cost Savings

1.5Scope

- **It provides sensitivity to the client and adapts well to the**
- **Future spam techniques**
- **It considers a complete message instead of single words with**
- **Respect to its organization**
- **It increases security and control**
- **It reduces IT administration costs**
- **It also reduce Network Resource costs**

1.3 Future work

The future work of email spam detection will likely focus on addressing emerging challenges and leveraging advanced technologies to improve detection accuracy, efficiency, and user experience. Here are some potential areas of future research and development

- **Deep Learning Techniques**:
- **Unsupervised Learning Approaches**
- **Multi-Modal Analysis**
- **Contextual Analysis**
- **Adversarial Defense Mechanisms**:
- **Privacy-Preserving Techniques**
- **Real-Time Feedback Loops**:
- **Cross-Platform Integration**
- **Explainable AI (XAI)**:

CHAPTER 2

SERVICES AND TOOLS REQUIRED

2.1 Services Used

Email spam detection typically involves the utilization of various services, both standalone and integrated within larger email security solutions. Here are some key services commonly used for email spam detection

Email Authentication Service

URL and Domain Reputation Services

Threat Intelligence Feeds

Machine Learning and AI Services

Anomaly Detection Services

Reporting and Feedback Mechanisms

Cloud-Based Spam Filtering Services

Managed Security Services

Anti-Spam Filtering Services

2.2 Tools and Software used

Tools and software used of email spam detection

Cisco Email Security

Microsoft Exchange Online Protection (EOP)

SpamTitan

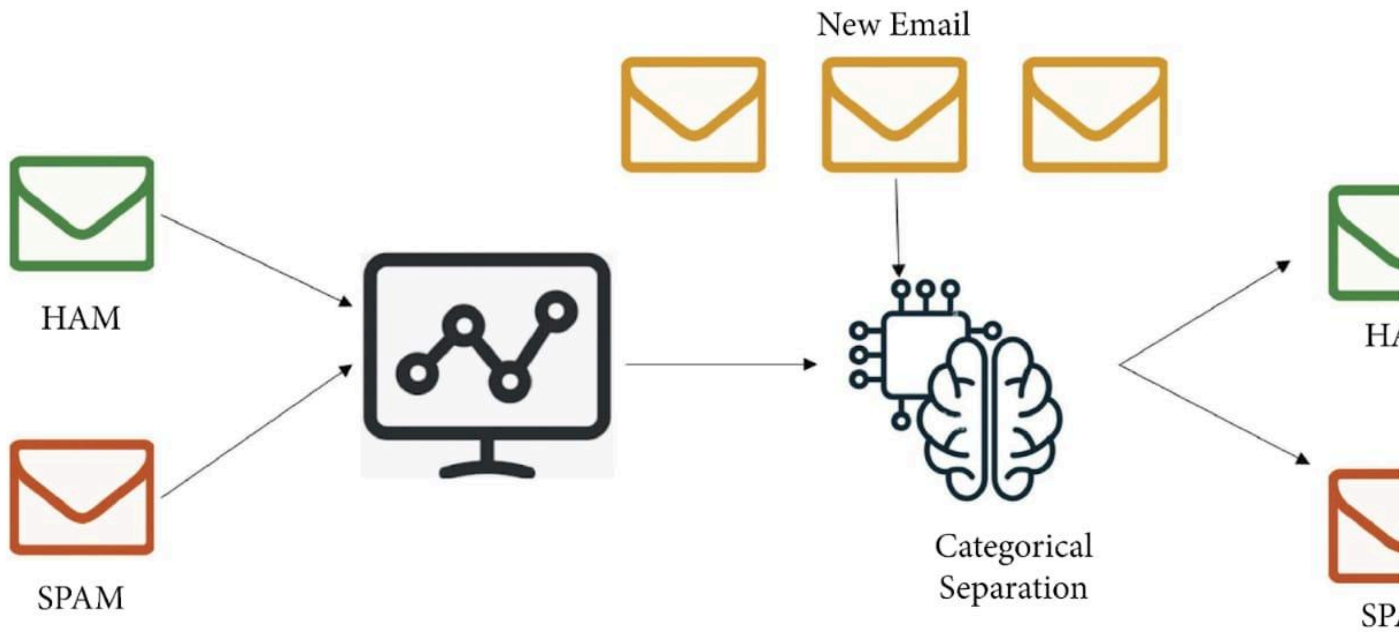
SpamAssassin

MailScanner

CHAPTER 3

PROJECT ARCHITECTURE

3.1 Architecture



CHAPTER 4

PROJECT OUTCOME

The project outcome of an email spam detection endeavor can vary depending on the specific goals, scope, and requirements of the project. However, here are some potential project outcomes that can be achieved:

1. **Development of a Functional Spam Detection System**: The primary outcome of the project may be the successful development and implementation of a functional email spam detection system. This system would be capable of automatically classifying incoming emails as either spam or legitimate based on various features and criteria.
2. **High Accuracy in Spam Detection**: The project outcome may include achieving high levels of accuracy in spam detection, as measured by metrics such as precision, recall, F1-score, and accuracy. A well-performing spam detection system should minimize false positives (legitimate emails classified as spam) and false negatives (spam emails classified as legitimate).
3. **Integration with Email Platforms**: The spam detection system may be integrated into email servers, clients, or filtering gateways to provide real-time protection against spam. Integration with existing email platforms ensures seamless operation and user accessibility.
4. **User-Friendly Interface**: The project may result in the development of a user-friendly interface that allows users to manage spam filtering preferences, view spam detection results, and provide feedback on detected emails. A intuitive interface enhances user experience and engagement with the spam detection system.
5. **Scalability and Efficiency**: The spam detection system should be scalable and efficient, capable of handling large volumes of incoming emails without significant performance degradation. Optimized algorithms and data processing techniques contribute to scalability and efficiency.
6. **Adaptability to New Threats**: The outcome may include mechanisms for continuous monitoring and adaptation to new spamming techniques and emerging threats. The spam detection system should be able to dynamically adjust its algorithms and criteria to effectively detect and mitigate evolving spam campaigns.
7. **Compliance with Regulations**: If applicable, the project outcome may involve ensuring compliance with relevant regulations and standards governing email communications and data privacy. This may include adherence to regulations such as the CAN-SPAM Act or GDPR.
8. **Documentation and Reporting**: Comprehensive documentation and reporting on the project outcomes, including details of the spam detection system architecture, algorithms used, performance metrics achieved, and user feedback. Clear documentation facilitates knowledge transfer and future maintenance of the system.

9. **Training and Support Materials**: Creation of training materials and user guides to assist users in understanding and effectively utilizing the spam detection system. Providing ongoing support and training ensures optimal use and adoption of the system.
10. **Evaluation and Validation**: The project outcome may include thorough evaluation and validation of the spam detection system's performance through testing, validation, and benchmarking against benchmark datasets or real-world email traffic. Validation ensures that the system meets the desired objectives and performance criteria.

```
import pandas as pd


Code cell <4Y2WaOc0EDuq>

# %% [code]

df = pd.read_csv('/content/archive.zip')

df

Execution output from Apr 20, 2024 12:59 PM

26KB

    text/plain

        Address    Lot AM or PM  \

        0     16629 Pace Camp Apt. 448\nAlexisborough, NE 77...  46 in
PM

        1     9374 Jasmine Spurs Suite 508\nSouth John, TN 8...  28 rn
PM

        2                    Unit 0065 Box 5052\nDPO AP 27450  94 vE
PM

        3                7780 Julia Fords\nNew Stacy, WA 45798  36 vm
PM

        4     23012 Munoz Drive Suite 337\nNew Cynthia, TX 5...  20 IE
AM

        ...                                                ...    ...
...

        9995      966 Castaneda Locks\nWest Juliafurt, CO 96415  92 XI
PM
```

```
      9996  832 Curtis Dam Suite 785\nNorth Edwardburgh, T...   41 JY
AM
      9997              Unit 4434 Box 6343\nDPO AE 28026-0283   74 Zh
AM
      9998               0096 English Rest\nRoystad, IA 12457   74 cL
PM
      9999     40674 Barrett Stravenue\nGrimesville, WI 79682   64 Hr
AM

                                                  Browser Info  \
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      1     Opera/8.93.(Windows 98; Win 9x 4.90; en-US) Pr...
      2     Mozilla/5.0 (compatible; MSIE 9.0; Windows NT ...
      3     Mozilla/5.0 (Macintosh; Intel Mac OS X 10_8_0 ...
      4     Opera/9.58.(X11; Linux x86_64; it-IT) Presto/2...
      ...                                                ...
      9995  Mozilla/5.0 (Windows NT 5.1) AppleWebKit/5352 ...
      9996  Mozilla/5.0 (compatible; MSIE 9.0; Windows NT ...
      9997  Mozilla/5.0 (Macintosh; U; Intel Mac OS X 10_7...
      9998  Mozilla/5.0 (Macintosh; Intel Mac OS X 10_8_8;...
      9999  Mozilla/5.0 (X11; Linux i686; rv:1.9.5.20) Gec...

                                      Company       Credit Card CC Exp
Date  \
      0                       Martinez-Herman  6011929061123406
02/20
      1     Fletcher, Richards and Whitaker  3337758169645356
11/18
      2          Simpson, Williams and Pham      675957666125
08/19
      3     Williams, Marshall and Buchanan  6011578504430710
02/24
```

```
4          Brown, Watson and Andrews  6011456623207998
10/25
...                                ...              ...
...
9995                   Randall-Sloan   342945015358701
03/22
9996         Hale, Collins and Wilson   210033169205009
07/25
9997                    Anderson Ltd  6011539787356311
05/21
9998                        Cook Inc   180003348082930
11/17
9999                      Greene Inc  4139972901927273
02/19

      CC Security Code                 CC Provider  \
0                  900                 JCB 16 digit
1                  561                   Mastercard
2                  699                 JCB 16 digit
3                  384                     Discover
4                  678  Diners Club / Carte Blanche
...                ...                          ...
9995               838                 JCB 15 digit
9996               207                 JCB 16 digit
9997                 1                VISA 16 digit
9998               987             American Express
9999               302                 JCB 15 digit

                              Email
Job  \
0                 pdunlap@yahoo.com  Scientist, product/process
development
```

```
        1                 anthony41@reed.com
Drilling engineer

        2     amymiller@morales-harrison.com                Customer
service manager

        3        brent16@olson-robinson.info
Drilling engineer

        4        christopherwright@gmail.com
Fine artist

        ...                              ...
...

        9995          iscott@wade-garner.com
Printmaker

        9996              mary85@hotmail.com
Energy engineer

        9997               tyler16@gmail.com
Veterinary surgeon

        9998         elizabethmoore@reid.net                Local
government officer

        9999           rachelford@vaughn.com
Embryologist, clinical


                   IP Address Language  Purchase Price

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        1        15.160.41.51       fr           70.73

        2      132.207.160.22       de            0.95

        3        30.250.74.19       es           78.04

        4        24.140.33.94       es           77.82

        ...               ...      ...             ...

        9995    29.73.197.114       it           82.21

        9996   121.133.168.51       pt           25.63

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Execution output from Apr 20, 2024 12:59 PM
23KB
    text/plain
        Address     Lot AM or PM  \
        0  16629 Pace Camp Apt. 448\nAlexisborough, NE 77...  46 in
PM
        1  9374 Jasmine Spurs Suite 508\nSouth John, TN 8...  28 rn
PM
        2                  Unit 0065 Box 5052\nDPO AP 27450  94 vE
PM
        3              7780 Julia Fords\nNew Stacy, WA 45798  36 vm
PM
        4  23012 Munoz Drive Suite 337\nNew Cynthia, TX 5...  20 IE
AM
        5  7502 Powell Mission Apt. 768\nTravisland, VA 3...  21 XT
PM
        6     93971 Conway Causeway\nAndersonburgh, AZ 75107  96 Xt
AM
        7  260 Rachel Plains Suite 366\nCastroberg, WV 24...  96 pG
PM
        8            2129 Dylan Burg\nNew Michelle, ME 28650  45 JN
PM
        9    3795 Dawson Extensions\nLake Tinafort, ID 88739  15 Ug
AM
```

```
                                        Browser Info  \
0  Opera/9.56.(X11; Linux x86_64; sl-SI) Presto/2...
1  Opera/8.93.(Windows 98; Win 9x 4.90; en-US) Pr...
2  Mozilla/5.0 (compatible; MSIE 9.0; Windows NT ...
3  Mozilla/5.0 (Macintosh; Intel Mac OS X 10_8_0 ...
4  Opera/9.58.(X11; Linux x86_64; it-IT) Presto/2...
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6  Mozilla/5.0 (compatible; MSIE 7.0; Windows NT ...
7  Mozilla/5.0 (X11; Linux i686) AppleWebKit/5350...
8  Mozilla/5.0 (Macintosh; U; Intel Mac OS X 10_7...
9  Mozilla/5.0 (X11; Linux i686; rv:1.9.7.20) Gec...

                          Company       Credit Card CC Exp Date  \
0                 Martinez-Herman  6011929061123406       02/20
1  Fletcher, Richards and Whitaker  3337758169645356       11/18
2       Simpson, Williams and Pham      675957666125       08/19
3  Williams, Marshall and Buchanan  6011578504430710       02/24
4        Brown, Watson and Andrews  6011456623207998       10/25
5                  Silva-Anderson    30246185196287       07/25
6                 Gibson and Sons  6011398782655569       07/24
7                Marshall-Collins      561252141909       06/25
8              Galloway and Sons   180041795790001       04/24
9    Rivera, Buchanan and Ramirez     4396283918371       01/17

   CC Security Code                  CC Provider  \
0               900                  JCB 16 digit
1               561                    Mastercard
2               699                  JCB 16 digit
```

```
        3                384                       Discover
        4                678  Diners Club / Carte Blanche
        5               7169                       Discover
        6                714                  VISA 16 digit
        7                256                  VISA 13 digit
        8                899                   JCB 16 digit
        9                931               American Express

                                  Email
Job  \
        0                pdunlap@yahoo.com  Scientist, product/process
development
        1               anthony41@reed.com                       Drilling
engineer
        2  amymiller@morales-harrison.com                Customer
service manager
        3     brent16@olson-robinson.info                       Drilling
engineer
        4     christopherwright@gmail.com
Fine artist
        5                ynguyen@gmail.com                       Fish
farm manager
        6               olivia04@yahoo.com
Dancer
        7             phillip48@parks.info                        Event
organiser
        8             kdavis@rasmussen.com
Financial manager
        9        qcoleman@hunt-huerta.com                      Forensic
scientist

                IP Address Language  Purchase Price
        0  149.146.147.205       el           98.14
```

```
        1      15.160.41.51        fr             70.73
        2    132.207.160.22        de              0.95
        3      30.250.74.19        es             78.04
        4      24.140.33.94        es             77.82
        5     55.96.152.147        ru             25.15
        6    127.252.144.18        de             88.56
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# %% [code]
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PM
        9991                PSC 8165, Box 8498\nAPO AP 60327-0346  50 dA
AM
        9992  885 Allen Mountains Apt. 230\nWallhaven, LA 16995  40 vH
PM
        9993  7555 Larson Locks Suite 229\nEllisburgh, MA 34...  72 jg
PM
        9994       6276 Rojas Hollow\nLake Louis, WY 56410-7837  93 Ex
PM
        9995      966 Castaneda Locks\nWest Juliafurt, CO 96415  92 XI
PM
        9996  832 Curtis Dam Suite 785\nNorth Edwardburgh, T...  41 JY
AM
```

```
      9997               Unit 4434 Box 6343\nDPO AE 28026-0283  74 Zh
AM
      9998                0096 English Rest\nRoystad, IA 12457  74 cL
PM
      9999     40674 Barrett Stravenue\nGrimesville, WI 79682  64 Hr
AM

                                                 Browser Info  \
      9990  Mozilla/5.0 (Macintosh; Intel Mac OS X 10_7_4;...
      9991  Mozilla/5.0 (compatible; MSIE 8.0; Windows NT ...
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      9993  Mozilla/5.0 (Macintosh; U; Intel Mac OS X 10_8...
      9994  Opera/9.68.(X11; Linux x86_64; sl-SI) Presto/2...
      9995  Mozilla/5.0 (Windows NT 5.1) AppleWebKit/5352 ...
      9996  Mozilla/5.0 (compatible; MSIE 9.0; Windows NT ...
      9997  Mozilla/5.0 (Macintosh; U; Intel Mac OS X 10_7...
      9998  Mozilla/5.0 (Macintosh; Intel Mac OS X 10_8_8;...
      9999  Mozilla/5.0 (X11; Linux i686; rv:1.9.5.20) Gec...

                          Company       Credit Card CC Exp Date
\
      9990  Pace, Vazquez and Richards   869968197049750      04/24
      9991                 Snyder Inc  4221582137197481      02/24
      9992                  Wells Ltd  4664825258997302      10/20
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      9994               Ritter-Smith  3112186784121077      01/25
      9995             Randall-Sloan   342945015358701      03/22
      9996    Hale, Collins and Wilson   210033169205009      07/25
      9997               Anderson Ltd  6011539787356311      05/21
      9998                   Cook Inc   180003348082930      11/17
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        9999                  Greene Inc  4139972901927273       02/19


              CC Security Code       CC Provider
Email  \
        9990                877      JCB 15 digit
andersonmichael@sherman.biz
        9991                969           Voyager
kking@wise-liu.com
        9992                431          Discover
bberry@wright.net
        9993                629           Maestro
chelseawilliams@lopez.biz
        9994               1823           Maestro
iroberts@gmail.com
        9995                838      JCB 15 digit
iscott@wade-garner.com
        9996                207      JCB 16 digit
mary85@hotmail.com
        9997                  1     VISA 16 digit
tyler16@gmail.com
        9998                987  American Express
elizabethmoore@reid.net
        9999                302      JCB 15 digit
rachelford@vaughn.com


                                       Job       IP Address Language
Purchase Price
        9990           Early years teacher     54.170.3.185       ru
18.35
        9991         IT sales professional    254.25.31.156       el
25.93
        9992                  Set designer    174.173.51.32       de
67.96
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        9993  Designer, exhibition/display    177.46.82.128        el
65.61
        9994     Education officer, museum    242.44.112.18        zh
31.85
        9995                    Printmaker    29.73.197.114        it
82.21
        9996               Energy engineer   121.133.168.51        pt
25.63
        9997            Veterinary surgeon    156.210.0.254        el
83.98
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38.84
        9999        Embryologist, clinical  176.119.198.199        el
67.59


Code cell <3VzAu3NhFctO>
# %% [code]
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        Address                    object
        Lot                        object
        AM or PM                   object
        Browser Info               object
        Company                    object
        Credit Card                 int64
        CC Exp Date                object
        CC Security Code            int64
        CC Provider                object
        Email                      object
```

```
        Job                     object
        IP Address              object
        Language                object
        Purchase Price         float64
        dtype: object

Code cell <4kRhlHwhFklA>
# %% [code]
df.isnull().sum()
Execution output from Apr 20, 2024 1:00 PM
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        Lot                    0
        AM or PM               0
        Browser Info           0
        Company                0
        Credit Card            0
        CC Exp Date            0
        CC Security Code       0
        CC Provider            0
        Email                  0
        Job                    0
        IP Address             0
        Language               0
        Purchase Price         0
        dtype: int64

Code cell <Puw3FdOWFvwW>
```

```
# %% [code]
len(df.columns)
Execution output from Apr 20, 2024 1:00 PM
0KB
    text/plain
        14

Code cell <FZ4aC5uRF_UQ>
# %% [code]
len(df)
Execution output from Apr 20, 2024 1:00 PM
0KB
    text/plain
        10000

Code cell <Sx62YDL8GErF>
# %% [code]
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Execution output from Apr 20, 2024 1:00 PM
1KB
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        <class 'pandas.core.frame.DataFrame'>
        RangeIndex: 10000 entries, 0 to 9999
        Data columns (total 14 columns):
         #   Column             Non-Null Count  Dtype
        ---  ------             --------------  -----
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         1   Lot                10000 non-null  object
         2   AM or PM           10000 non-null  object
```

```
         3   Browser Info       10000 non-null  object
         4   Company            10000 non-null  object
         5   Credit Card        10000 non-null  int64
         6   CC Exp Date        10000 non-null  object
         7   CC Security Code   10000 non-null  int64
         8   CC Provider        10000 non-null  object
         9   Email              10000 non-null  object
         10  Job                10000 non-null  object
         11  IP Address         10000 non-null  object
         12  Language           10000 non-null  object
         13  Purchase Price     10000 non-null  float64
        dtypes: float64(1), int64(2), object(11)
        memory usage: 1.1+ MB


Code cell <VMtrxIM1GJ1I>
# %% [code]
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Execution output from Apr 20, 2024 1:00 PM
0KB
    text/plain
        Index(['Address', 'Lot', 'AM or PM', 'Browser Info', 'Company',
'Credit Card',
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'Email', 'Job',
               'IP Address', 'Language', 'Purchase Price'],
              dtype='object')


Code cell <J8LbEhVpGhLD>
# %% [code]
df['Purchase Price'].max()
```

```
Execution output from Apr 20, 2024 1:00 PM

0KB

    text/plain

        99.99


Code cell <ASl0WNTxHCsT>

# %% [code]

df['Purchase Price'].min()

Execution output from Apr 20, 2024 1:00 PM

0KB

    text/plain

        0.0


Code cell <0fj9MwJCHRp2>

# %% [code]

df['Purchase Price'].mean()

Execution output from Apr 20, 2024 1:00 PM

0KB

    text/plain

        50.347302


Code cell <q8d5tyc0Hc5C>

# %% [code]

df.columns

Execution output from Apr 20, 2024 1:00 PM

0KB

    text/plain

        Index(['Address', 'Lot', 'AM or PM', 'Browser Info', 'Company',
'Credit Card',
```

```
               'CC Exp Date', 'CC Security Code', 'CC Provider',
'Email', 'Job',
               'IP Address', 'Language', 'Purchase Price'],
              dtype='object')


Code cell <esOY5-8-HmDS>
# %% [code]
df['Language']=='fr'
Execution output from Apr 20, 2024 1:00 PM
0KB
    text/plain
        0       False
        1        True
        2       False
        3       False
        4       False
                ...
        9995    False
        9996    False
        9997    False
        9998    False
        9999    False
        Name: Language, Length: 10000, dtype: bool


Code cell <Q-3fffM-HwNq>
# %% [code]
len(df[df['Language']=='fr'])
Execution output from Apr 20, 2024 1:00 PM
0KB
```

```
    text/plain
        1097


Code cell <kybgEUgjIEn3>
# %% [code]
df[df['Language']=='fr'].count()
Execution output from Apr 20, 2024 1:00 PM
1KB
    text/plain
        Address              1097
        Lot                  1097
        AM or PM             1097
        Browser Info         1097
        Company              1097
        Credit Card          1097
        CC Exp Date          1097
        CC Security Code     1097
        CC Provider          1097
        Email                1097
        Job                  1097
        IP Address           1097
        Language             1097
        Purchase Price       1097
        dtype: int64


Code cell <hSEwKEPgIT-0>
# %% [code]
df.columns
Execution output from Apr 20, 2024 1:00 PM
```

```
0KB

    text/plain

        Index(['Address', 'Lot', 'AM or PM', 'Browser Info', 'Company',
'Credit Card',

               'CC Exp Date', 'CC Security Code', 'CC Provider',
'Email', 'Job',

               'IP Address', 'Language', 'Purchase Price'],

              dtype='object')


Code cell <ARLft1GuIa4e>

# %% [code]

len(df[df['Job'].str.contains('engineer',case=False)])

Execution output from Apr 20, 2024 1:00 PM

0KB

    text/plain

        984


Code cell <EDmqWDciJOEP>

# %% [code]

df.columns

Execution output from Apr 20, 2024 1:01 PM

0KB

    text/plain

        Index(['Address', 'Lot', 'AM or PM', 'Browser Info', 'Company',
'Credit Card',

               'CC Exp Date', 'CC Security Code', 'CC Provider',
'Email', 'Job',

               'IP Address', 'Language', 'Purchase Price'],

              dtype='object')
```

```
Code cell <m4Zalu90JU77>

# %% [code]

df[df['IP Address']=="132.207.160.22"]['Email']

Execution output from Apr 20, 2024 1:01 PM

0KB

    text/plain

        2    amymiller@morales-harrison.com

        Name: Email, dtype: object


Code cell <NG88q-RJD2k0>

# %% [code]

len(df[(df['CC Provider']=="MasterCard") & (df['Purchase Price']>50)])

Execution output from Apr 20, 2024 1:01 PM

0KB

    text/plain

        0


Code cell <a2j5EPv6J2Ac>

# %% [code]

df[(df['CC Provider']=="Mastercard") \

 & (df['Purchase Price']>50)].count()

Execution output from Apr 20, 2024 1:01 PM

0KB

    text/plain

        Address                405

        Lot                    405

        AM or PM               405

        Browser Info           405

        Company                405
```

```
        Credit Card          405
        CC Exp Date          405
        CC Security Code     405
        CC Provider          405
        Email                405
        Job                  405
        IP Address           405
        Language             405
        Purchase Price       405
        dtype: int64

Code cell <hXzJ3YUWKZ2c>
# %% [code]
df[df['Credit Card']==4664825258997302]["Email"]
Execution output from Apr 20, 2024 1:01 PM
0KB
    text/plain
        9992    bberry@wright.net
        Name: Email, dtype: object

Code cell <c-yFukLXKlAk>
# %% [code]
df['AM or PM'].value_counts()
Execution output from Apr 20, 2024 1:01 PM
0KB
    text/plain
        AM or PM
        PM    5068
        AM    4932
```

```
        Name: count, dtype: int64


Code cell <GhrdUDX6LjhM>

# %% [code]

df['CC Exp Date']

Execution output from Apr 20, 2024 1:01 PM

0KB

    text/plain

        0       02/20

        1       11/18

        2       08/19

        3       02/24

        4       10/25

                ...

        9995    03/22

        9996    07/25

        9997    05/21

        9998    11/17

        9999    02/19

        Name: CC Exp Date, Length: 10000, dtype: object


Code cell <OPySwPYALvTv>

# %% [code]

def fun():

    count=0

    for date in df['CC Exp Date']:

        if date.split('/')[1]=='20':

         count=count+1

    print(count)
```

```
Code cell <CXaujC7tMz-x>

# %% [code]

fun()

Execution output from Apr 20, 2024 1:01 PM

0KB

    Stream

        988


Code cell <K2w5C6nZM2NR>

# %% [code]

len(df[df['CC Exp Date'].apply(lambda x:x [3:]=='20')])

Execution output from Apr 20, 2024 1:01 PM

0KB

    text/plain

        988


Code cell <6rBTv07vNXjg>

# %% [code]

list1=[]

for email in df['Email']:

  list1.append(email.split('@')[1])


Code cell <Ytg7P7PWNvAX>

# %% [code]

df['temp']=list1


Code cell <L6EqDwnkN1dD>

# %% [code]
```

```
df.head(1)

Execution output from Apr 20, 2024 1:01 PM

11KB

    text/plain

        Address    Lot AM or PM  \

        0  16629 Pace Camp Apt. 448\nAlexisborough, NE 77...  46 in
PM



                                                Browser Info
Company  \

        0  Opera/9.56.(X11; Linux x86_64; sl-SI) Presto/2...
Martinez-Herman



                Credit Card CC Exp Date  CC Security Code   CC Provider
\

        0  6011929061123406       02/20               900  JCB 16 digit



                       Email                                    Job
IP Address  \

        0  pdunlap@yahoo.com  Scientist, product/process development
149.146.147.205



          Language  Purchase Price       temp

        0       el           98.14  yahoo.com



Code cell <np5SwK-dN6e6>

# %% [code]

df['temp'].value_counts().head()

Execution output from Apr 20, 2024 1:02 PM

0KB

    text/plain
```

```
        temp
        hotmail.com     1638
        yahoo.com       1616
        gmail.com       1605
        smith.com         42
        williams.com      37
        Name: count, dtype: int64


Code cell <77sJk4q1OJm8>
# %% [code]
df['Email'].apply(lambda x:x.split('@')[1]).value_counts().head()
Execution output from Apr 20, 2024 1:02 PM
0KB
    text/plain
        Email
        hotmail.com     1638
        yahoo.com       1616
        gmail.com       1605
        smith.com         42
        williams.com      37
        Name: count, dtype: int64
```

CONCLUSION

Email has been the most important medium of communication nowadays, through internet connectivity any message can be delivered to all aver the world. More than 270 billion emails are exchanged daily, about 57% of these are just spam emails. Spam emails, also known as non-self, are undesired commercial or malicious emails, which affects or hacks personal information like bank ,related to money or anything that causes destruction to single individual or a corporation or a group of people. Besides advertising, these may contain links to phishing or malware hosting websites set up to steal confidential information. Spam is a serious issue that is not just annoying to the end-users but also financially damaging and a security risk. Hence this system is designed in such a way that it detects unsolicited and unwanted emails and prevents them hence helping in reducing the spam message which would be of great benefit to individuals as well as to the company .In the future this system can be implemented by using different algorithms and also more features can be added to the existing system.

FUTURE SCOPE

The future scope of email spam detection is wide-ranging and holds considerable potential for innovation and improvement. Here are several areas that represent promising directions for future development

- Enhanced Accuracy with AI and Machine Learning
- Behavioral Analysis and Contextual Understanding
- Multi-Modal Analysis
- Real-Time Threat Intelligence and Collaboration
- Privacy-Preserving Techniques
- Cross-Platform Integration
- Adaptive and Self-Learning Systems
- Explainable AI (XAI)

REFERENCES

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[2] S. Nandhini and J. Marseline K.S., "Performance Evaluation of Machine Learning Algorithms for Email Spam Detection," in International Conference on Emerging Trends in Information Technology and Engineering (ic-ETITE), 2020.

[3] A. L. a. S. S. S. Gadde, "SMS Spam Detection using Machine Learning and Deep Learning Techniques," in 7th International Conference on Advanced Computing and Communication Systems (ICACCS), 2021, 2021.

[4] V. B. a. B. K. P. Sethi, "SMS spam detection and comparison of various machine learning algorithms," in International Conference on Computing and Communication Technologies for Smart Nation (IC3TSN), 2017.

[5] G. D. a. A. R. P. Navaney, "SMS Spam Filtering Using Supervised Machine Learning Algorithms," in 8th International Conference on Cloud Computing, Data Science & Engineering (Confluence), 2018

CODE

Please Provide Code through Git Hub Repo Link

https://github.com/Srirameee21/codessriram

VIDEO IN GITHUB LINK

https://github.com/Srirameee21/codessriram/blob/main/README.md

PPT LINK IN GITHUB

https://github.com/Srirameee21/codessriram/blob/main/PPT_sriram%20b.pptx