

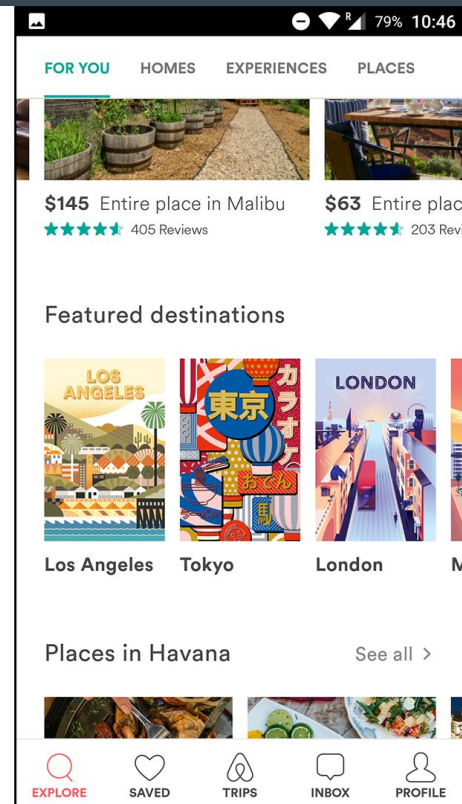
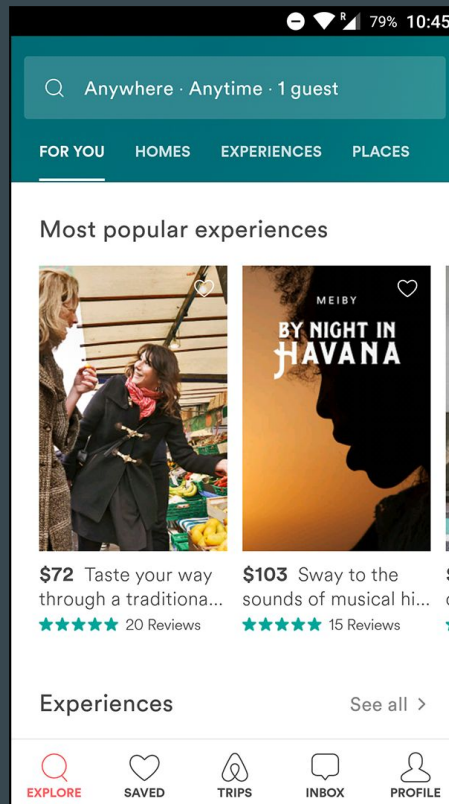
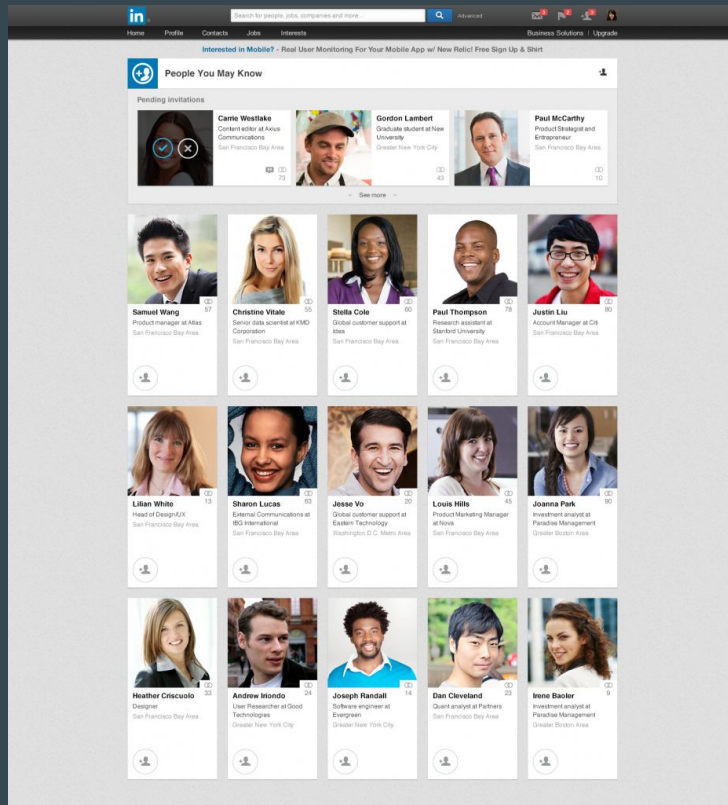
# Recommendation Systems in Python

Joshua Bernhard

# Defining a Recommendation System

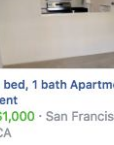
“Any system that produces individualized recommendations as output or has the effect of guiding the user in a personalized way to interesting or useful objects in a large space of possible options.” - Burke, 2002

# Examples of Recommendation Systems




# Examples of Recommendation Systems

**Recommended for You Nearby**



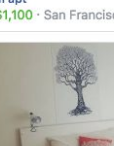
**1 bed, 1 bath Apartment for rent**  
**\$1,000** • San Francisco, CA

[View Details](#)



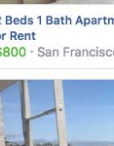
**One bedroom in a 4 bedroom m apt**  
**\$1,100** • San Francisco, CA

[View Details](#)



**2 Beds 1 Bath Apartment f or Rent**  
**\$800** • San Francisco, CA

[View Details](#)




**Room in Nob Hill**  
**\$1,340** • San Francisco, CA

[View Details](#)



**Skip the guesswork. See the best credit card for you.**


The advertisement features a blue background with a smartphone and a laptop. The smartphone screen shows the Credit Karma app interface with the text: "What do you want your new card to do?", "Use it to:", "Access funds in a flash", and "Manage money on your terms". The laptop screen displays "Your results are in" and lists three credit cards: Chase Freedom, Chase Freedom Unlimited, and Chase Freedom Flex. The Chase Freedom Flex card is highlighted with a green "Get this card" button. Below the cards, the text "The Basics" is visible, followed by a table with columns for "Annual Fee", "SPIN", and "Interest Rate". The table shows values for "None", "SPIN", and "12.99% - 24.99%".



## Recommended for You


Amazon.com has new recommendations for you based on [items](#) you purchased or told us you own.

---




**Google Apps**  
Deciphered: Compute in the Cloud to Streamline Your Desktop

[Google Apps Deciphered: Compute in the Cloud to Streamline Your Desktop](#)



**Google Apps**  
Administrator Guide: A Private-Label Web Workshop

[Google Apps Administrator Guide: A Private-Label Web Workshop](#)



**Googlepedia**  
The Ultimate Google Resource (3rd Edition)

[Googlepedia: The Ultimate Google Resource \(3rd Edition\)](#)



# Types of Recommendation Systems

- Collaborative Filtering Recommenders
- Demographic Recommenders
- Content Based Recommenders
- Utility Based Recommenders
- Knowledge Based Recommenders

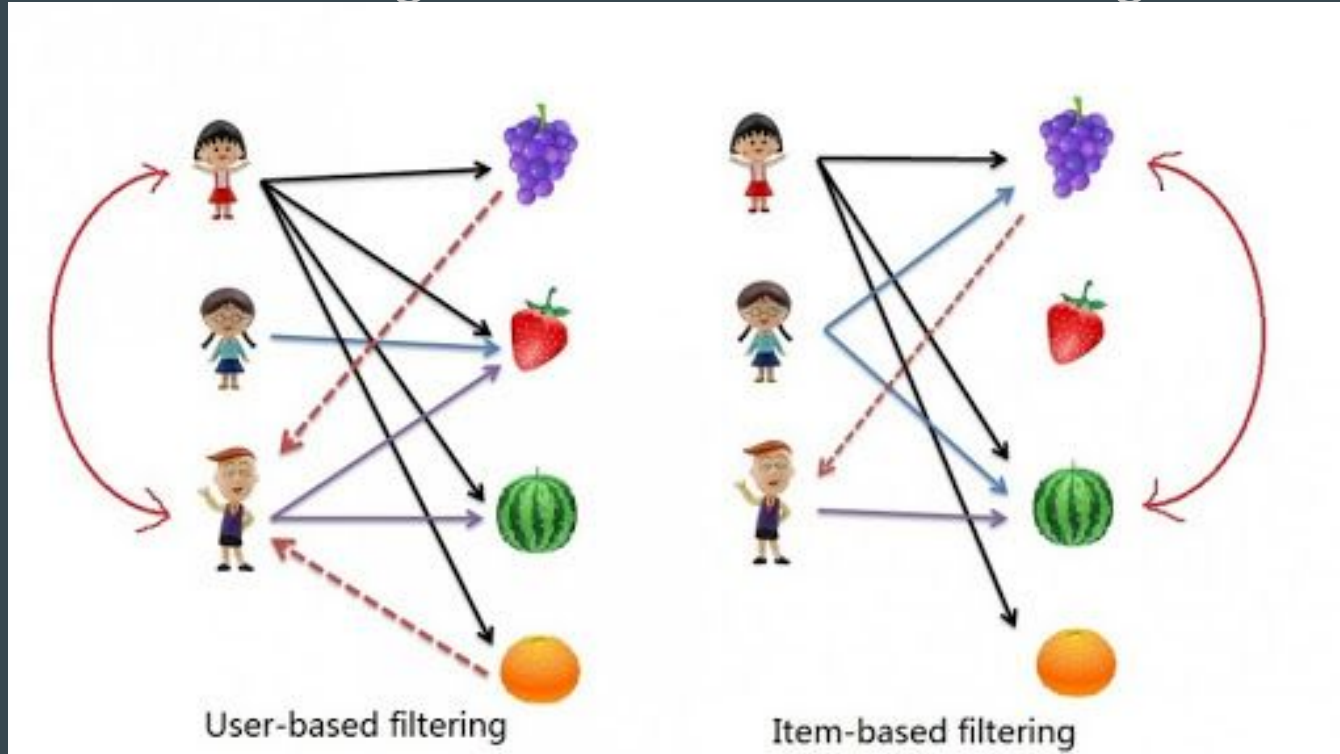
# **Types of Recommendation Systems**

# **Collaborative Filtering Recommenders**

# Collaborative Filtering

user-user ratings

item-item ratings





# **Demographic Based Recommenders**

# Demographic Based Recommenders

- Common Applications
  - Dating Apps
  - Doctor Recommendations
- Common Characteristics
  - Location
  - Age
  - Gender
  - Family History

The screenshot shows a mobile app interface with a teal header bar containing the text 'POF'. Below the header, the text 'Complete this questionnaire!' is displayed. A red note states '\*All Fields Are Mandatory'. The form consists of several fields, each with a label and a dropdown menu:

- City: [Dropdown]
- Postal code / Zip: [Dropdown]
- My Gender: Male [Dropdown]
- Seeking: Female [Dropdown]
- Height: 6'1" (185 cm) [Dropdown]
- I Am Looking For: Hang Out [Dropdown]
- Hair Color: Black [Dropdown]
- Body Type: Prefer Not To Say [Dropdown]
- Do you have a car?: Prefer Not To Say [Dropdown]
- Describe your personality in one word: Select [Dropdown]
- Second Language: No Second Language [Dropdown]
- How ambitious are you?: Select [Dropdown]

# **Content Based Recommenders**

# Content Based Recommenders

- Common Applications
  - Books - Amazon
    - Similar genres
    - Similar authors
  - Movies - Netflix
    - Similar actors, actresses, and directors
  - Clothing - Stitch Fix
    - Similar style



# Utility Based Recommenders

# Utility Based Recommenders

- This is similar to traditional, supervised machine learning
  - Then rank response values
  - Lots of possible applications
- 

What we know

about the user

rating for each item

$$f(X) \rightarrow Y$$

# **Knowledge Based Recommenders**

# Knowledge Based Recommenders

- Common Applications
  - Homes
  - Cars
  - Vacations

From: Zillow <[recommended.homes@mail.zillow.com](mailto:recommended.homes@mail.zillow.com)>  
Subject: 4 Recommended Homes For You  
Date: March 19, 2019 at 4:41:29 AM CDT  
To: Ted Dabrowski



## Recommendations

We found 4 new recommendations.



● FOR SALE  
\$39,900  
3 bd, 1.0 ba, 1,020 sqft  
[14907 Leavitt Ave, Harvey, IL](#)  
[People like you liked this home](#)

Property taxes: \$3,259  
Effective tax rate: 8.2 percent



● FOR SALE  
\$38,333  
3 bd, 1.0 ba, 1,040 sqft  
[388 Calumet Blvd, Harvey, IL](#)  
[People like you liked this home](#)

Property taxes: \$4,273  
Effective tax rate: 11.1 percent



● FORECLOSURE  
\$35,500  
3 bd, 3.0 ba, 1,648 sqft  
[16049 Wood St, Harvey, IL](#)  
[New Listing](#)

Property taxes: \$5,764  
Effective tax rate: 16.2 percent



● FOR SALE  
\$75,000  
4 bd, 2.0 ba, 1,395 sqft  
[16623 Carse Ave, Harvey, IL](#)  
[New Listing](#)

Property taxes: \$7,626  
Effective tax rate: 10.2 percent

[See all matching results](#)

[Unsubscribe from this email](#)

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Note: Wirepoints added property taxes and effective tax rate to the email.



# Recap

To be successful, recommendations should be individualized, interesting, and useful.

## Types of Recommenders

- Collaborative Filtering Recommenders
- Demographic Recommenders
- Content Based Recommenders
- Utility Based Recommenders
- Knowledge Based Recommenders