Amzn_apparel_recommendation_Excercise

February 14, 2019

0.1 Excercise: Build a weighted Nearest Neighbor model using visual,brand,text and color?

```
In [4]: from PIL import Image #support for opening,manipulating,saving any different file form
        import requests #deals with url's
        from io import BytesIO #data can be kept as in-memory buffer which is faster
        import matplotlib.pyplot as plt #for graphs and visualization
        import numpy as np #for numerical computation
        import pandas as pd #for data manipulation
        import warnings #to avoid errors
        from bs4 import BeautifulSoup #for webscrapping
        from nltk.corpus import stopwords #to avoid stopwords
        from nltk.tokenize import word_tokenize #splits text into words
        import nltk #natural language toolkit library
        import math #for math operations
        import time #for printing excution time
        import re #delas with regular expression
        import os #for reading and writing to system
        import seaborn as sns #for effective visualisation
        from collections import Counter #counter
        from sklearn.feature_extraction.text import CountVectorizer #extract text features and
        from sklearn.feature_extraction.text import TfidfVectorizer #tf-idf transformer
        from sklearn.metrics.pairwise import cosine_similarity #computes similarity with dot p
        from sklearn.metrics import pairwise_distances #computes distance matrice
        from matplotlib import gridspec #specifies geometry of gird that a subplot will be pla
        from scipy.sparse import hstack #horizontal stack sparse matrix horizontally
        import plotly #for 3d visualization
        import plotly.figure_factory as ff #wrapper function contains unique chart types
        from plotly.graph_objs import Scatter, Layout #defines size and layout

        plotly.offline.init_notebook_mode(connected=True)
        warnings.filterwarnings("ignore")
```

```
In [5]: #after removing duplicates and stop words we got 16k_apparel_data_preprocessed pickle
        data = pd.read_pickle('pickels/16k_apperal_data_preprocessed')
        data.head()
```

```
Out[5]:           asin                          brand              color  \
        4   B004GSI2OS                     FeatherLite  Onyx Black/ Stone
```

```
6   B012YX2ZPI  HX-Kingdom Fashion T-shirts               White
15  B003BSRPB0                  FeatherLite               White
27  B014ICEJ1Q                        FNC7C              Purple
46  B01NACPBG2                 Fifth Degree               Black

                                     medium_image_url product_type_name  \
4   https://images-na.ssl-images-amazon.com/images...             SHIRT
6   https://images-na.ssl-images-amazon.com/images...             SHIRT
15  https://images-na.ssl-images-amazon.com/images...             SHIRT
27  https://images-na.ssl-images-amazon.com/images...             SHIRT
46  https://images-na.ssl-images-amazon.com/images...             SHIRT

                                                title formatted_price
4   featherlite ladies long sleeve stain resistant...          $26.26
6   womens unique 100 cotton  special olympics wor...           $9.99
15  featherlite ladies moisture free mesh sport sh...          $20.54
27  supernatural chibis sam dean castiel neck tshi...           $7.39
46  fifth degree womens gold foil graphic tees jun...           $6.95
```

```
In [ ]:
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```
In [6]: idf_title_vectorizer = CountVectorizer()
        idf_title_features = idf_title_vectorizer.fit_transform(data['title'])
```

```
In [7]: def n_containing(word):
            # return the number of documents which had the given word
            return sum(1 for blob in data['title'] if word in blob.split())

        def idf(word):
            # idf = log(#number of docs / #number of docs which had the given word)
            return math.log(data.shape[0] / (n_containing(word)))
```

```
In [8]: # we need to convert the values into float
        idf_title_features  = idf_title_features.astype(np.float)

        for i in idf_title_vectorizer.vocabulary_.keys():
            # for every word in whole corpus we will find its idf value
            idf_val = idf(i)

            # to calculate idf_title_features we need to replace the count values with the idf
            # idf_title_features[:, idf_title_vectorizer.vocabulary_[i]].nonzero()[0] will ret
            for j in idf_title_features[:, idf_title_vectorizer.vocabulary_[i]].nonzero()[0]:

                # we replace the count values of word i in document j with  idf_value of word
                # idf_title_features[doc_id, index_of_word_in_courpus] = idf value of word
                idf_title_features[j,idf_title_vectorizer.vocabulary_[i]] = idf_val
```

```
In [ ]:
```

```
In [9]: from gensim.models import Word2Vec
        from gensim.models import KeyedVectors
        import pickle
        with open('word2vec_model', 'rb') as handle:
            model = pickle.load(handle)
```

```
In [10]: # vocab = stores all the words that are there in google w2v model
         # vocab = model.wv.vocab.keys() # if you are using Google word2Vec

         vocab = model.keys()
         # this function will add the vectors of each word and returns the avg vector of given
         def build_avg_vec(sentence, num_features, doc_id, m_name):
             # sentace: its title of the apparel
             # num_features: the lenght of word2vec vector, its values = 300
             # m_name: model information it will take two values
                 # if  m_name == 'avg', we will append the model[i], w2v representation of wor
                 # if m_name == 'weighted', we will multiply each w2v[word] with the idf(word)

             featureVec = np.zeros((num_features,), dtype="float32")
             # we will intialize a vector of size 300 with all zeros
             # we add each word2vec(wordi) to this fetureVec
             nwords = 0

             for word in sentence.split():
                 nwords += 1
                 if word in vocab:
                     if m_name == 'weighted' and word in  idf_title_vectorizer.vocabulary_:
                         featureVec = np.add(featureVec, idf_title_features[doc_id, idf_title_v
                     elif m_name == 'avg':
                         featureVec = np.add(featureVec, model[word])
             if(nwords>0):
                 featureVec = np.divide(featureVec, nwords)
             # returns the avg vector of given sentance, its of shape (1, 300)
             return featureVec
```

```
In [ ]:
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```
In [11]: doc_id = 0
         w2v_title_weight = []
         # for every title we build a weighted vector representation
         for i in data['title']:
             w2v_title_weight.append(build_avg_vec(i, 300, doc_id,'weighted'))
             doc_id += 1
         # w2v_title = np.array(# number of doc in courpus * 300), each row corresponds to a d
         w2v_title_weight = np.array(w2v_title_weight)
```

```
In [12]: import numpy as np #numerical computation
         from keras.preprocessing.image import ImageDataGenerator#processing image
         from keras.models import Sequential #creating sequential model
         from keras.layers import Dropout, Flatten, Dense #sequential model with droput,flatte
         from keras import applications #to use pretrained models on imagenet
         from sklearn.metrics import pairwise_distances #for distance
         import matplotlib.pyplot as plt #for visualization
         import requests #for url dealing
         from PIL import Image #for image manipulating, saving diff formats
         import pandas as pd # for data processing
         import pickle #for faster loading
```

```
Using TensorFlow backend.
```

```
In [13]: #load the features and corresponding ASINS info.
         bottleneck_features_train = np.load('16k_data_cnn_features.npy')
         asins = np.load('16k_data_cnn_feature_asins.npy')
         asins = list(asins)

         # load the original 16K dataset
         data = pd.read_pickle('pickels/16k_apperal_data_preprocessed')
         df_asins = list(data['asin'])

         from IPython.display import display, Image, SVG, Math, YouTubeVideo
```

```
In [14]: # some of the brand values are empty.
         # Need to replace Null with string "NULL"
         data['brand'].fillna(value="Not given", inplace=True )

         # replace spaces with hypen
         brands = [x.replace(" ", "-") for x in data['brand'].values]
         types = [x.replace(" ", "-") for x in data['product_type_name'].values]
         colors = [x.replace(" ", "-") for x in data['color'].values]

         brand_vectorizer = CountVectorizer()
         brand_features = brand_vectorizer.fit_transform(brands)

         type_vectorizer = CountVectorizer()
         type_features = type_vectorizer.fit_transform(types)

         color_vectorizer = CountVectorizer()
         color_features = color_vectorizer.fit_transform(colors)

         extra_features = hstack((brand_features, type_features, color_features)).tocsr()
```

```
In [15]: def predicter(doc_id,document_id, w1, w2,w3, num_results):
             # doc_id: apparel's id in given corpus
             # w1: weight for  w2v features
             # w2: weight for brand and color features

             # pairwise_dist will store the distance from given input apparel to all remaining
```

```
    # the metric we used here is cosine, the coside distance is mesured as K(X, Y) =
    # http://scikit-learn.org/stable/modules/metrics.html#cosine-similarity
    idf_w2v_dist  = pairwise_distances(w2v_title_weight, w2v_title_weight[doc_id].resh

    ex_feat_dist = pairwise_distances(extra_features, extra_features[doc_id])

    document_id = asins.index(df_asins[document_id])
    imge_dist = pairwise_distances(bottleneck_features_train, bottleneck_features_tra


    pairwise_dist   = (w1 * idf_w2v_dist +  w2 * ex_feat_dist + w3 * imge_dist)/float

    # np.argsort will return indices of 9 smallest distances
    indices = np.argsort(pairwise_dist.flatten())[0:num_results]
    #pdists will store the 9 smallest distances
    pdists  = np.sort(pairwise_dist.flatten())[0:num_results]

    #data frame indices of the 9 smallest distace's
    df_indices = list(data.index[indices])

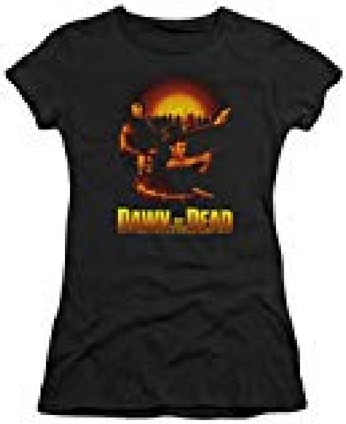

    for i in range(len(indices)):
        rows = data[['medium_image_url','title']].loc[data['asin']==asins[indices[i]]
        for indx, row in rows.iterrows():
            display(Image(url=row['medium_image_url'], embed=True))
            print('Product Title: ', row['title'])
            print('Euclidean Distance from input image:', pdists[i])
            print('Amazon Url: www.amzon.com/dp/'+ asins[indices[i]])
            print('='*125)

predicter(12566,4,5, 5, 5, 20)
# in the give heat map, each cell contains the euclidean distance between words i, j
```

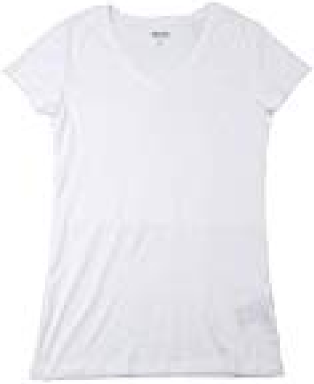
```
Product Title:  fifth degree womens gold foil graphic tees junior top short sleeve printed shi
Euclidean Distance from input image: 3.977887420100486
Amazon Url: www.amzon.com/dp/B01NACPBG2
==============================================================================================
```

```
Product Title:  juniors vampire diaries  threes party juniors slim tshirt size l
Euclidean Distance from input image: 15.642939289967494
Amazon Url: www.amzon.com/dp/B00IAAFXB8
==============================================================================================
```

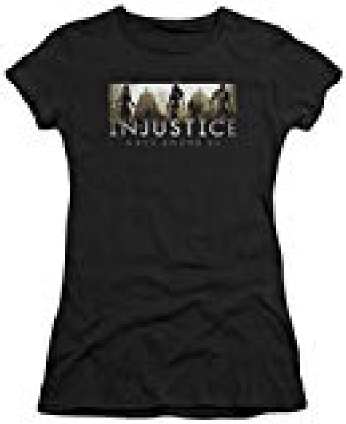
```
Product Title:  juniors army  type juniors slim tshirt size xl
Euclidean Distance from input image: 16.004749084075566
Amazon Url: www.amzon.com/dp/B00XCXG24U
==============================================================================================
```



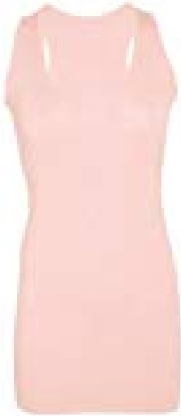
```
Product Title:  juniors dawn dead  dawn collage juniors slim tshirt size l
Euclidean Distance from input image: 16.127595011634146
Amazon Url: www.amzon.com/dp/B00IAAT6AW
==============================================================================================
```



```
Product Title:  kirkland signature ladies size medium cotton vneck tee white
Euclidean Distance from input image: 16.19614283255861
Amazon Url: www.amzon.com/dp/B073ZRD5FL
==============================================================================================
```



```
Product Title:  juniors injustice gods among us  logo juniors slim tshirt size xxl
Euclidean Distance from input image: 16.41968158936528
Amazon Url: www.amzon.com/dp/B00IABTN0A
==============================================================================================
```



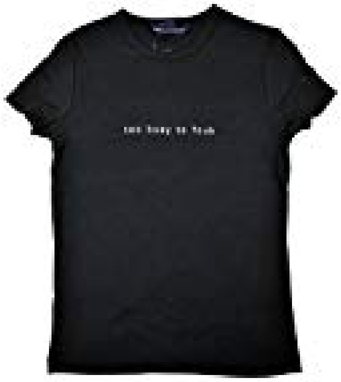
```
Product Title:  funky boutique womens sleeveless racer back muscle vest 810 sm nude
Euclidean Distance from input image: 16.435762023925783
Amazon Url: www.amzon.com/dp/B00HW0HAP4
==============================================================================================
```

```
Product Title:  greensource womens born lucky tee regal red xxl
Euclidean Distance from input image: 16.461862437171256
Amazon Url: www.amzon.com/dp/B00BGEM4QC
==============================================================================================
```

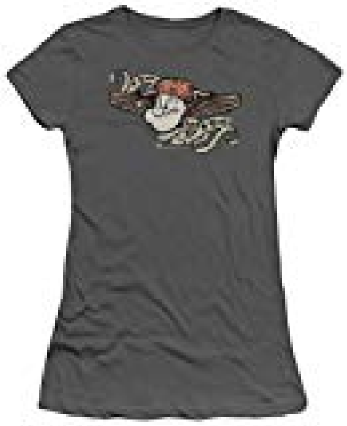
```
Product Title:  tommy hilfiger women slim fit crewneck logo tshirt xxl dark grey
Euclidean Distance from input image: 16.594748179358756
Amazon Url: www.amzon.com/dp/B00B5FD7J0
==============================================================================================
```

```
Product Title:  juniors knight rider  logo juniors slim tshirt size l
Euclidean Distance from input image: 16.59568837483724
Amazon Url: www.amzon.com/dp/B00IABLRY0
==============================================================================================
```

```
Product Title:  vivienne tam black blouse top size xs
Euclidean Distance from input image: 16.647571858326867
Amazon Url: www.amzon.com/dp/B01EXP65XI
==============================================================================================
```



```
Product Title:  french connection black busy fcuk short sleeve tshirt xs xsmall
Euclidean Distance from input image: 16.662836499530115
Amazon Url: www.amzon.com/dp/B01BUI92SG
==============================================================================================
```



```
Product Title:  juniors popeye  yam juniors slim tshirt size l
Euclidean Distance from input image: 16.701837667070343
Amazon Url: www.amzon.com/dp/B00IAAC2C6
==============================================================================================
```

```
Product Title:  juniors criminal minds  crew juniors slim tshirt size
Euclidean Distance from input image: 16.708326721432325
Amazon Url: www.amzon.com/dp/B00DEHOELW
==============================================================================================
```

```
Product Title:  juniors law  order svu juniors slim tshirt size xl
Euclidean Distance from input image: 16.729017893714225
Amazon Url: www.amzon.com/dp/B00IAAGUJC
==============================================================================================
```

```
Product Title:  juniors grease  tell stud juniors slim tshirt size xxl
Euclidean Distance from input image: 16.729263600270226
Amazon Url: www.amzon.com/dp/B00IQYQ7LS
==============================================================================================
```

```
Product Title:  miller  high life juniors tshirt  large
Euclidean Distance from input image: 16.795723978919302
Amazon Url: www.amzon.com/dp/B001GPK8G4
==============================================================================================
```

```
Product Title:  funky boutique womens sleeveless racer back muscle vest  810 sm cream
Euclidean Distance from input image: 16.857227365732466
Amazon Url: www.amzon.com/dp/B00FXRN3KO
===============================================================================================
```

```
Product Title:  juniors cry baby  kiss juniors slim tshirt size xl
Euclidean Distance from input image: 17.00546497559575
Amazon Url: www.amzon.com/dp/B00IAAF85E
===============================================================================================
```

```
Product Title:  anna kaci sm fit classic white shoulder bare short sleeve peplum flare blouse
Euclidean Distance from input image: 17.04981566325851
Amazon Url: www.amzon.com/dp/B010EH3B8Q
=====================================================================================
```

```
In [16]: predicter(12566,4,5, 5, 10, 20)
```

```
Product Title:  fifth degree womens gold foil graphic tees junior top short sleeve printed shi
Euclidean Distance from input image: 2.9969472112078335
Amazon Url: www.amzon.com/dp/B01NACPBG2
=====================================================================================
```

```
Product Title:  juniors vampire diaries  threes party juniors slim tshirt size l
Euclidean Distance from input image: 20.794418365180697
Amazon Url: www.amzon.com/dp/B00IAAFXB8
==============================================================================================
```

```
Product Title:  juniors army  type juniors slim tshirt size xl
Euclidean Distance from input image: 21.37935450714847
Amazon Url: www.amzon.com/dp/B00XCXG24U
==============================================================================================
```

```
Product Title:  juniors dawn dead  dawn collage juniors slim tshirt size l
Euclidean Distance from input image: 21.587640381040064
Amazon Url: www.amzon.com/dp/B00IAAT6AW
==============================================================================================
```

```
Product Title:  funky boutique womens sleeveless racer back muscle vest 810 sm nude
Euclidean Distance from input image: 21.701344680786132
Amazon Url: www.amzon.com/dp/B00HW0HAP4
==============================================================================================
```

```
Product Title:  french connection black busy fcuk short sleeve tshirt xs xsmall
Euclidean Distance from input image: 21.90831282996985
Amazon Url: www.amzon.com/dp/B01BUI92SG
===============================================================================================
```

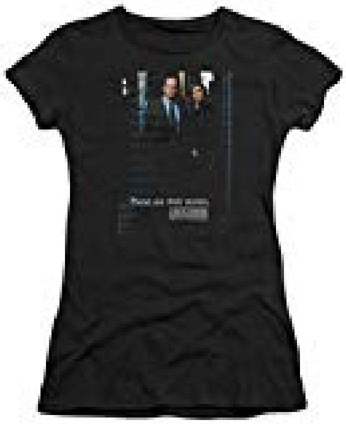
```
Product Title:  greensource womens born lucky tee regal red xxl
Euclidean Distance from input image: 21.961509132565944
Amazon Url: www.amzon.com/dp/B00BGEM4QC
===============================================================================================
```

```
Product Title:  juniors injustice gods among us  logo juniors slim tshirt size xxl
Euclidean Distance from input image: 22.031710654914583
Amazon Url: www.amzon.com/dp/B00IABTN0A
===============================================
```

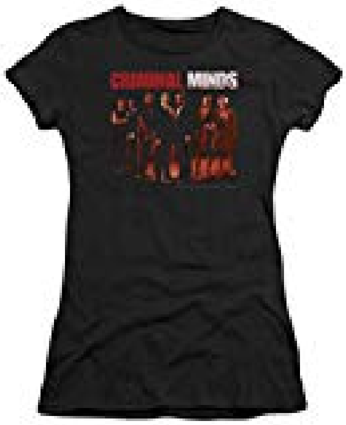
```
Product Title:  juniors grease  tell stud juniors slim tshirt size xxl
Euclidean Distance from input image: 22.205878669440953
Amazon Url: www.amzon.com/dp/B00IQYQ7LS
===============================================
```

```
Product Title:  tommy hilfiger women slim fit crewneck logo tshirt xxl dark grey
Euclidean Distance from input image: 22.236077308835473
Amazon Url: www.amzon.com/dp/B00B5FD7J0
===============================================================================================
```

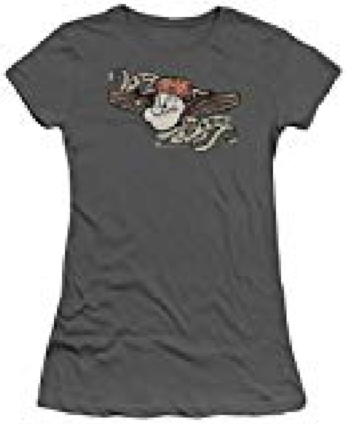
```
Product Title:  juniors knight rider  logo juniors slim tshirt size l
Euclidean Distance from input image: 22.24799919128418
Amazon Url: www.amzon.com/dp/B00IABLRY0
===============================================================================================
```



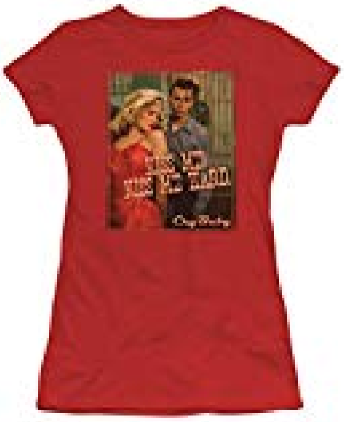
```
Product Title:  juniors law  order svu juniors slim tshirt size xl
Euclidean Distance from input image: 22.33051662463137
Amazon Url: www.amzon.com/dp/B00IAAGUJC
==============================================================================================
```



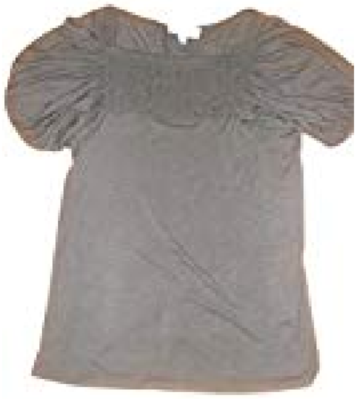
```
Product Title:  juniors criminal minds  crew juniors slim tshirt size
Euclidean Distance from input image: 22.393103408994165
Amazon Url: www.amzon.com/dp/B00DEHOELW
==============================================================================================
```



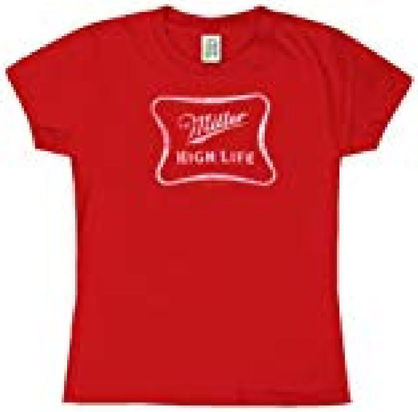
```
Product Title:  juniors popeye  yam juniors slim tshirt size l
Euclidean Distance from input image: 22.3965419771094
Amazon Url: www.amzon.com/dp/B00IAAC2C6
==============================================================================================
```



```
Product Title:  juniors cry baby  kiss juniors slim tshirt size xl
Euclidean Distance from input image: 22.463867408454625
Amazon Url: www.amzon.com/dp/B00IAAF85E
==============================================================================================
```

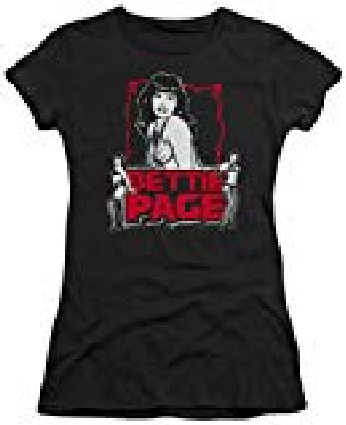


```
Product Title:  vivienne tam black blouse top size xs
Euclidean Distance from input image: 22.474535400092808
Amazon Url: www.amzon.com/dp/B01EXP65XI
==============================================================================================
```



```
Product Title:  miller  high life juniors tshirt  large
Euclidean Distance from input image: 22.47697410601565
Amazon Url: www.amzon.com/dp/B001GPK8G4
==============================================================================================
```

```
Product Title:  funky boutique womens sleeveless racer back muscle vest  810 sm cream
Euclidean Distance from input image: 22.632791740119664
Amazon Url: www.amzon.com/dp/B00FXRN3K0
==============================================================================================
```

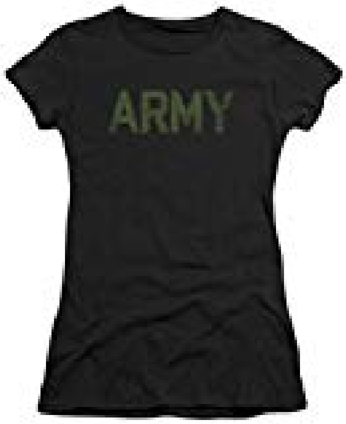


```
Product Title:  juniors bettie page  betties scary hot juniors slim tshirt size
Euclidean Distance from input image: 22.76830474371641
Amazon Url: www.amzon.com/dp/B00IAA7MBM
==============================================================================================
```

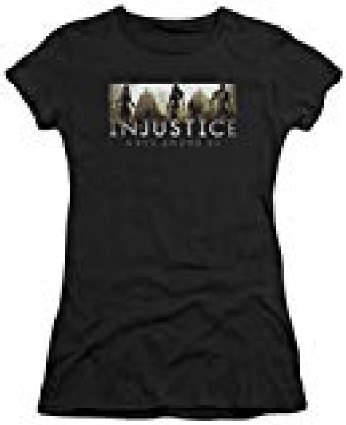
```
Product Title:  women slim lace carved patchwork tshirt tops tees shirt l  us black
Euclidean Distance from input image: 22.836701774777858
Amazon Url: www.amzon.com/dp/B00MBARBLS
==============================================================================================
```

```
In [21]: predicter(15676,4,5, 15, 5, 15) #recommend only 15 with different weights
```

```
Product Title:  fifth degree womens gold foil graphic tees junior top short sleeve printed shi
Euclidean Distance from input image: 2.2744683527946474
Amazon Url: www.amzon.com/dp/B01NACPBG2
==============================================================================================
```



```
Product Title:  juniors army  type juniors slim tshirt size xl
Euclidean Distance from input image: 9.50281517920007
Amazon Url: www.amzon.com/dp/B00XCXG24U
====================================================================================================
```



```
Product Title:  juniors injustice gods among us  logo juniors slim tshirt size xxl
Euclidean Distance from input image: 9.919854134888546
Amazon Url: www.amzon.com/dp/B00IABTN0A
====================================================================================================
```

```
Product Title:  pink rose juniors sideslit handkerchie pop royal xs
Euclidean Distance from input image: 9.99155876159668
Amazon Url: www.amzon.com/dp/B071L4XNDG
==============================================================================================
```

```
Product Title:  juniors criminal minds  crew juniors slim tshirt size
Euclidean Distance from input image: 10.005759672085922
Amazon Url: www.amzon.com/dp/B00DEHOELW
==============================================================================================
```

```
Product Title:  juniors dawn dead  dawn collage juniors slim tshirt size l
Euclidean Distance from input image: 10.007570203702134
Amazon Url: www.amzon.com/dp/B00IAAT6AW
==============================================================================================
```

```
Product Title:  miller  high life juniors tshirt  large
Euclidean Distance from input image: 10.013899015347642
Amazon Url: www.amzon.com/dp/B001GPK8G4
==============================================================================================
```

```
Product Title:  juniors grease  tell stud juniors slim tshirt size xxl
Euclidean Distance from input image: 10.119246529908077
Amazon Url: www.amzon.com/dp/B00IQYQ7LS
==============================================================================================
```

```
Product Title:  juniors popeye  yam juniors slim tshirt size l
Euclidean Distance from input image: 10.144632963101548
Amazon Url: www.amzon.com/dp/B00IAAC2C6
==============================================================================================
```

```
Product Title:  juniors vampire diaries  threes party juniors slim tshirt size l
Euclidean Distance from input image: 10.165807415056724
Amazon Url: www.amzon.com/dp/B00IAAFXB8
==============================================================================================
```

```
Product Title:  cyrus ladies small ribbed texture pullover tunic sweater black
Euclidean Distance from input image: 10.178588928755193
Amazon Url: www.amzon.com/dp/B06XN6R331
==============================================================================================
```

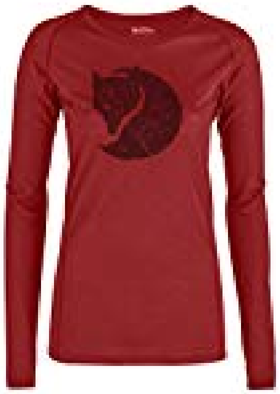
```
Product Title:  tommy hilfiger women slim fit crewneck logo tshirt xxl dark grey
Euclidean Distance from input image: 10.190612272183579
Amazon Url: www.amzon.com/dp/B00B5FD7J0
===============================================================================================
```

```
Product Title:  lizwear liz claiborne womens short sleeve mesh printed top blackbrown small
Euclidean Distance from input image: 10.200372323365109
Amazon Url: www.amzon.com/dp/B00A2SRY50
===============================================================================================
```

```
Product Title:  code v womens fine jersey camo tee shirt xl pink woodland
Euclidean Distance from input image: 10.223094415039913
Amazon Url: www.amzon.com/dp/B001JC47RA
===============================================================================================
```

```
Product Title:  anna kaci sm fit classic purple balloon sleeve slit back intricate design top
Euclidean Distance from input image: 10.24278328833093
Amazon Url: www.amzon.com/dp/B010EH3YHY
===============================================================================================
```

```
In [24]: predicter(15676,33,5, 15, 5, 20) #recommend only 15 with different weights
```



```
Product Title:  fjallraven  womens abisko trail tshirt printed longsleeve lava xxs
Euclidean Distance from input image: 1.6390311958573898
Amazon Url: www.amzon.com/dp/B073WLKVN9
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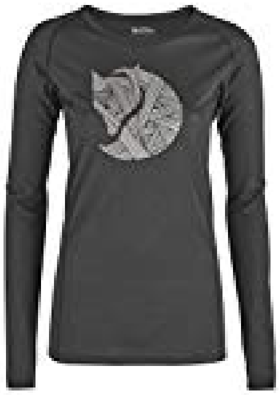
```



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Product Title:  fjallraven  womens abisko trail tshirt printed longsleeve dark grey xxs
Euclidean Distance from input image: 7.739531475115317
Amazon Url: www.amzon.com/dp/B073WL6NH1
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```

```
Product Title:  lrl lauren jeans co womens metallic striped knit henley xs black
Euclidean Distance from input image: 8.464552597578436
Amazon Url: www.amzon.com/dp/B01AGSCRUG
==============================================================================================
```

```
Product Title:  womens robot friday logo long sleeve tshirt
Euclidean Distance from input image: 8.694768380494015
Amazon Url: www.amzon.com/dp/B01KLR83A0
==============================================================================================
```

```
Product Title:  shires ladies base layer top xlarge red
Euclidean Distance from input image: 9.041601037354367
Amazon Url: www.amzon.com/dp/B06XRDVT37
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```

```
Product Title:  yatyler customized led zeppelin bluesrock longsleeved tee shirts ladies black
Euclidean Distance from input image: 9.114697579712765
Amazon Url: www.amzon.com/dp/B019IEU3T6
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```

```
Product Title:  pikolai women casual long sleeve knitted bandage sweaters tshirt blouse xl bla
Euclidean Distance from input image: 9.144088605801743
Amazon Url: www.amzon.com/dp/B01LZ2B1HT
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```

```
Product Title:  zshow womens long sleeve casual loose tunic tops girlsarmy greenmedium
Euclidean Distance from input image: 9.191529626221554
Amazon Url: www.amzon.com/dp/B071NTKYPG
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```

```
Product Title:  kjus ladies feel printed halfzip 2017 black 38
Euclidean Distance from input image: 9.19636826888768
Amazon Url: www.amzon.com/dp/B01M3V3AJJ
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```

```
Product Title:  pluspice womens sexy lace softest ribbed top plussize 1xl deep red
Euclidean Distance from input image: 9.245653699795884
Amazon Url: www.amzon.com/dp/B01N00F80D
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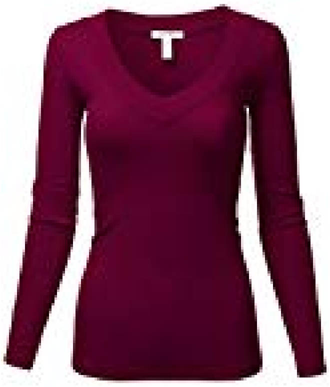
```



```
Product Title:  basic fitted sexy knit long sleeve vneck tee tops
Euclidean Distance from input image: 9.247273191373033
Amazon Url: www.amzon.com/dp/B01A9G8NPS
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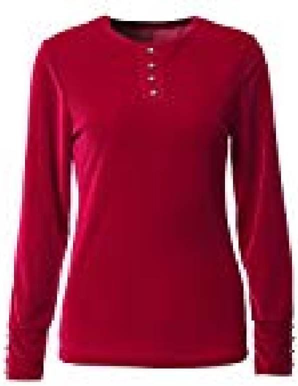

```
Product Title:  sodialr womens fashion long sleeve velvet topsredxlus12
Euclidean Distance from input image: 9.28825966772546
Amazon Url: www.amzon.com/dp/B06XC25J1T
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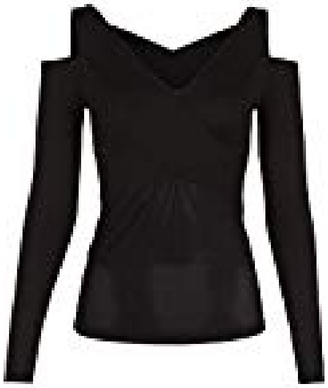

```
Product Title:  michi womens siren top black xsmall
Euclidean Distance from input image: 9.300004896084946
Amazon Url: www.amzon.com/dp/B01LW6Q6EG
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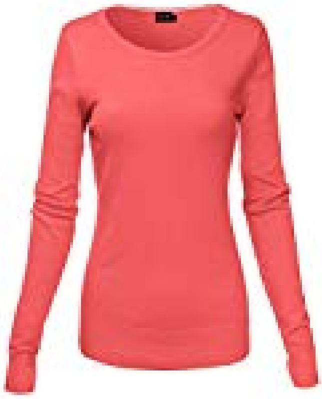

```
Product Title:  basic crew neck long sleeve soft sweater knit tops
Euclidean Distance from input image: 9.313914574952022
Amazon Url: www.amzon.com/dp/B01MG94GU9
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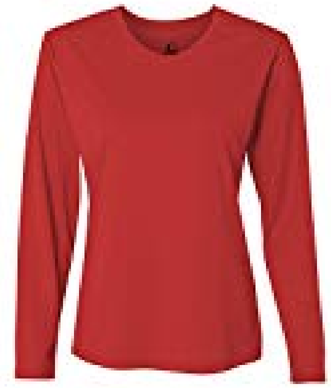
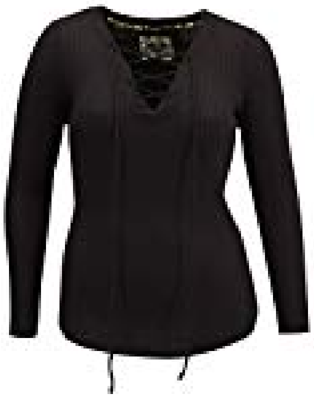


```
Product Title:  badger sport womens c2 long sleeve tee shirt large red
Euclidean Distance from input image: 9.480796293179672
Amazon Url: www.amzon.com/dp/B00R2TUDCM
==============================================================================================
```



```
Product Title:  pluspice womens lattice front long sleeve ribbed knit top red 1x
Euclidean Distance from input image: 9.520654386441391
Amazon Url: www.amzon.com/dp/B01MSWP4C9
==============================================================================================
```

```
Product Title:  basic crew neck long sleeve soft sweater knit tops 012black us xl
Euclidean Distance from input image: 9.61020860091893
Amazon Url: www.amzon.com/dp/B01J4RDGYQ
==============================================================================================
```

```
Product Title:  xiaohuang86 women shirts casual good
Euclidean Distance from input image: 9.62559808150975
Amazon Url: www.amzon.com/dp/B01M24XN6J
==============================================================================================
```

```
Product Title:  central park west rich color tshirt teal small
Euclidean Distance from input image: 9.640960935513657
Amazon Url: www.amzon.com/dp/B00JX10QEW
==============================================================================================
```

```
Product Title:  studio womens blue jersey draped hem long sleeves casual top shirt
Euclidean Distance from input image: 9.666941219378012
Amazon Url: www.amzon.com/dp/B01M05593J
==============================================================================================
```

```
In [ ]:
```