data_insights

September 8, 2019

This file discusses some observations from the data. Most of them are self-explainable through graphs.

`session_durantion` has some NANs, so they are interpolated.

```
In [1]: import pandas as pd
        import numpy as np
        df = pd.read_csv('Data.csv', delimiter=';')
        nan_df = df[df['hits'] == '\\N']
        df = df[df['hits'] != '\\N']
        df['session_durantion'] = df['session_durantion'].replace(to_replace='\\N',value =np.na
        df['session_durantion'].interpolate(method = 'spline', order = 3 ,inplace= True)
        df.tail()
```

Out[1]:

	row_num	locale	day_of_week	hour_of_day	agent_id	entry_page	\
988671	10	L4	Wednesday	23	10	8001	
988672	9	L1	Sunday	10	10	2113	
988674	7	L3	Tuesday	13	7	2113	
988675	6	L6	Friday	5	8	2113	
988680	1	L4	Thursday	15	1	2116	

	path_id_set	traffic_type	session_durantion	hits
988671	79178	1	173	3
988672	74017;0	2	813	69
988674	44337;0	2	621	37
988675	38715;0	4	0	2
988680	76673;0	2	4544	18

It is difficult to use `path_id_set` as it is. Therefore it is transformed to `path_length` and `path_imp`. The `path_length` stores the number of IDs each path has.

```
In [2]: df['path_id_set'] = df['path_id_set'].str.split(';')
        df['path_id_set'].loc[df['path_id_set'].isnull()] = df['path_id_set'].loc[df['path_id_s
        df['path_length'] = df['path_id_set'].apply(len)
        df.tail()
```

```
/Users/raghuramkalyanam/anaconda/lib/python3.6/site-packages/pandas/core/indexing.py:202: Setti
A value is trying to be set on a copy of a slice from a DataFrame
```

```
See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/user_guide/in
  self._setitem_with_indexer(indexer, value)
```

Out[2]:

	row_num	locale	day_of_week	hour_of_day	agent_id	entry_page	\
988671	10	L4	Wednesday	23	10	8001	
988672	9	L1	Sunday	10	10	2113	
988674	7	L3	Tuesday	13	7	2113	
988675	6	L6	Friday	5	8	2113	
988680	1	L4	Thursday	15	1	2116	

	path_id_set	traffic_type	session_durantion	hits	path_length
988671	[79178]	1	173	3	1
988672	[74017, 0]	2	813	69	2
988674	[44337, 0]	2	621	37	2
988675	[38715, 0]	4	0	2	2
988680	[76673, 0]	2	4544	18	2

path_imp stores the sum of weighted frequencies of each set of path_id_set.

In [3]:
```
import itertools
path_ids=[]
df['path_id_set'].apply(lambda x : path_ids.append(x))
path_ids_list =  list(itertools.chain(*path_ids))

import collections
counter = collections.Counter(path_ids_list)

def imp(counter):
    imp_dict = {}
    for key,value in dict(counter).items():
        imp_dict[key] = value/sum(counter.values())
    return imp_dict
imp_dict = imp(counter)

df['path_imp'] = df['path_id_set'].apply(lambda x : sum([imp_dict[i] for i in x]))
df.tail()
```

Out[3]:

	row_num	locale	day_of_week	hour_of_day	agent_id	entry_page	\
988671	10	L4	Wednesday	23	10	8001	
988672	9	L1	Sunday	10	10	2113	
988674	7	L3	Tuesday	13	7	2113	
988675	6	L6	Friday	5	8	2113	
988680	1	L4	Thursday	15	1	2116	

	path_id_set	traffic_type	session_durantion	hits	path_length	path_imp
988671	[79178]	1	173	3	1	0.000304
988672	[74017, 0]	2	813	69	2	0.438654
988674	[44337, 0]	2	621	37	2	0.440783

```
988675  [38715, 0]             4                 0    2            2  0.448925
988680  [76673, 0]             2              4544   18            2  0.438613
```

Similarly entry_page_imp is added. As entry_page can't be used directly.

```
In [4]: entry_page_counter = collections.Counter(df['entry_page'].tolist())
        entry_page_dict = imp(entry_page_counter)
        df['entry_page_imp'] = df['entry_page'].apply(lambda x : entry_page_dict[x])
        df.tail()
```

```
Out[4]:         row_num locale day_of_week  hour_of_day  agent_id  entry_page  \
        988671       10     L4   Wednesday           23        10        8001
        988672        9     L1      Sunday           10        10        2113
        988674        7     L3     Tuesday           13         7        2113
        988675        6     L6      Friday            5         8        2113
        988680        1     L4    Thursday           15         1        2116

               path_id_set  traffic_type session_durantion hits  path_length  \
        988671     [79178]             1               173    3            1
        988672  [74017, 0]             2               813   69            2
        988674  [44337, 0]             2               621   37            2
        988675  [38715, 0]             4                 0    2            2
        988680  [76673, 0]             2              4544   18            2

                path_imp  entry_page_imp
        988671  0.000304        0.017549
        988672  0.438654        0.332617
        988674  0.440783        0.332617
        988675  0.448925        0.332617
        988680  0.438613        0.202408
```

```
In [6]: df.columns
```

```
Out[6]: Index(['row_num', 'locale', 'day_of_week', 'hour_of_day', 'agent_id',
               'entry_page', 'path_id_set', 'traffic_type', 'session_durantion',
               'hits', 'path_length', 'path_imp', 'entry_page_imp'],
              dtype='object')
```

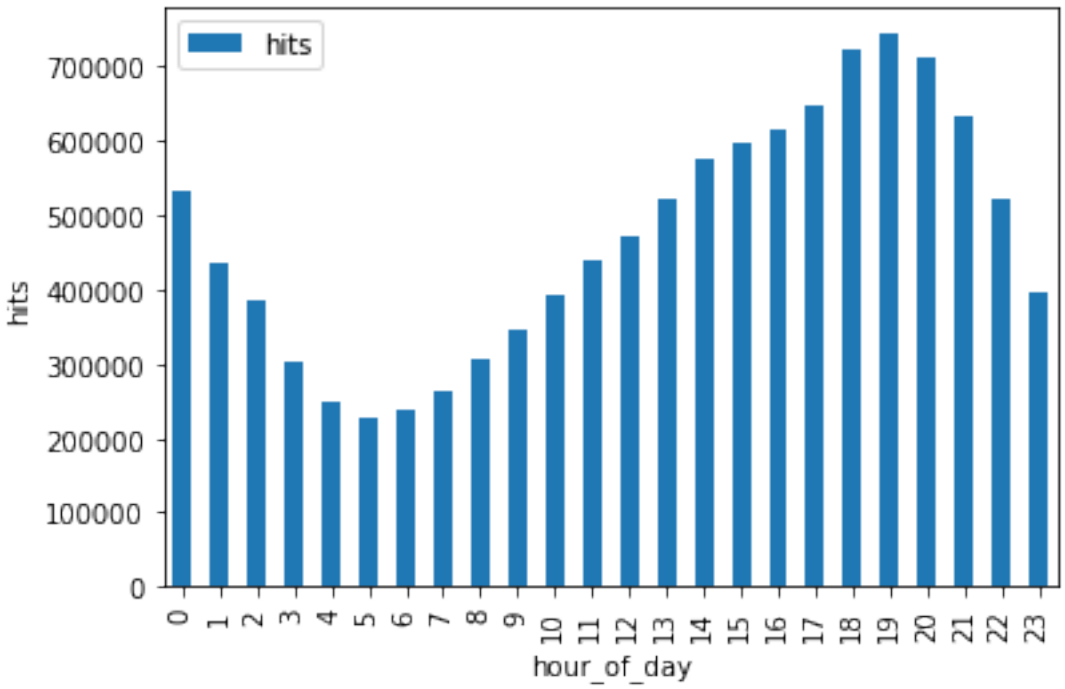
```
In [7]: df['session_durantion'] = pd.to_numeric(df['session_durantion'])
        df['hits'] = pd.to_numeric(df['hits'])
```

It looks like 19:00 has highest hits as well as highest frequency.

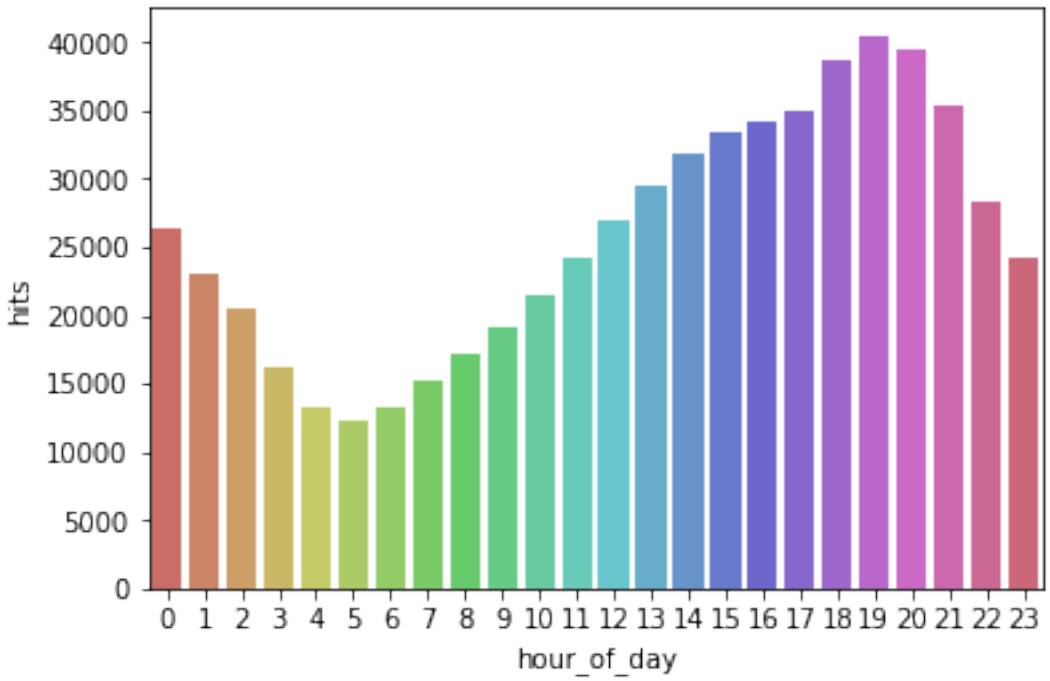
```
In [8]: %matplotlib inline

        #import pylab as plt
        import matplotlib.pyplot as plt
        import pandas as pd
        import seaborn as sns
```

```
np = pd.np
df.groupby('hour_of_day').agg({'hits':'sum'}).plot.bar(figsize=(6,4))
plt.ylabel('hits')
plt.show()
```

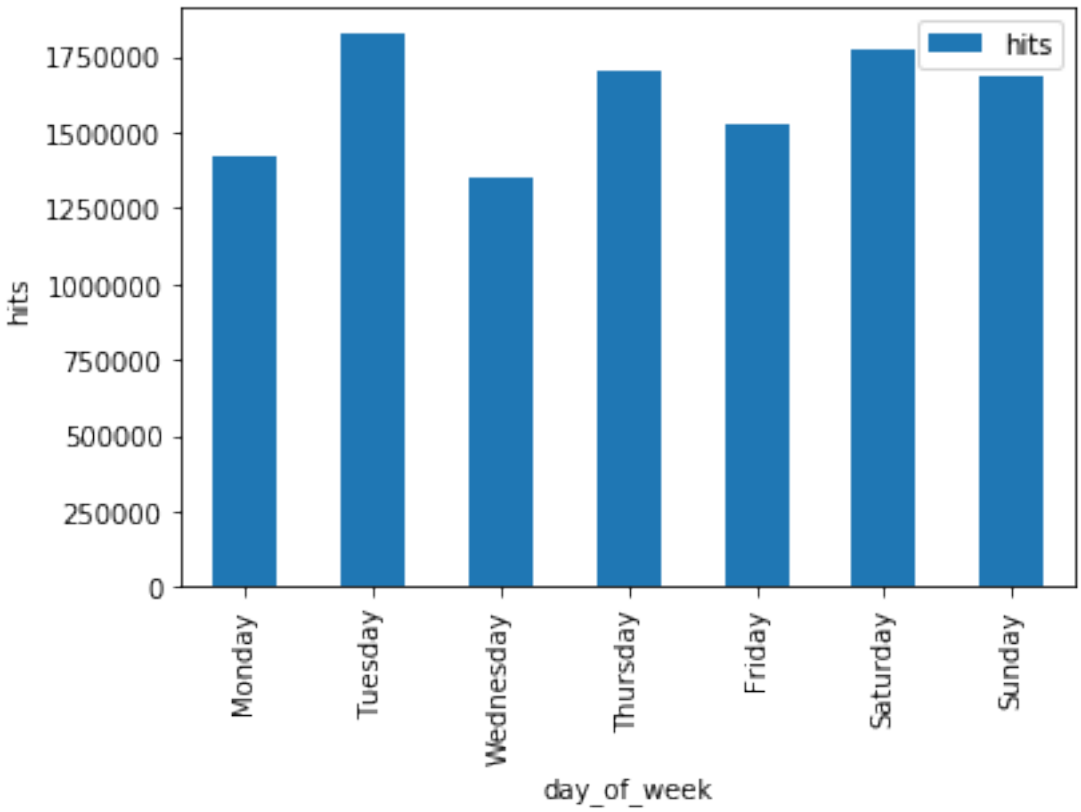


In [9]:
```
sns.countplot(x='hour_of_day',data=df, palette='hls')
plt.ylabel('Frequency')
plt.show()
```

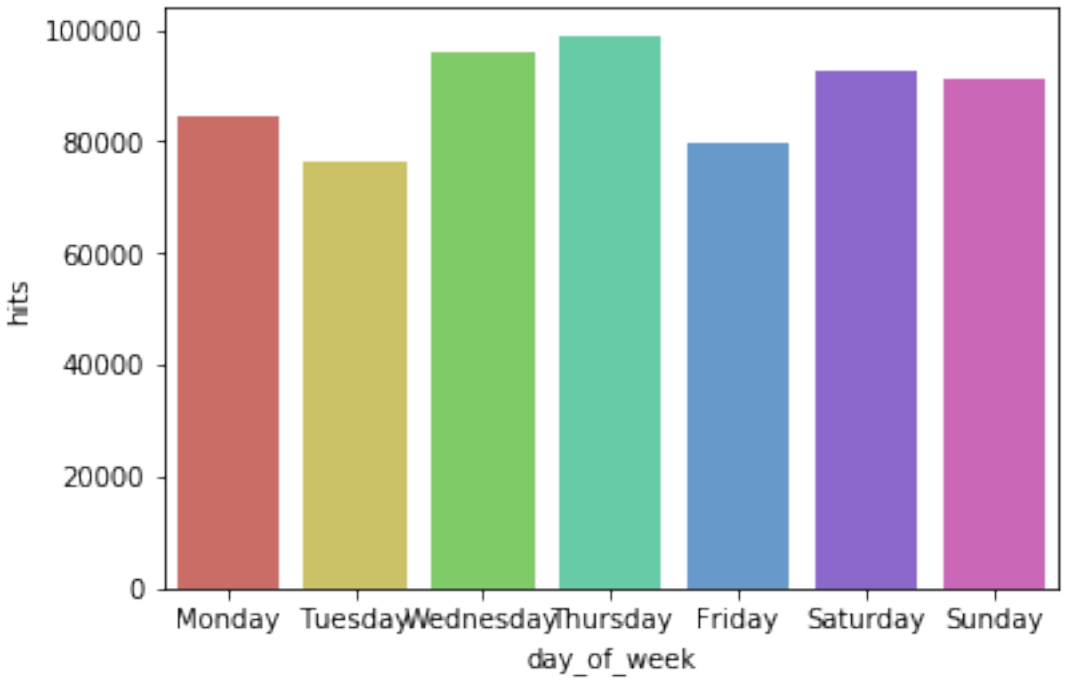


It looks like Tuesday has lowest frequency but highest hits.

```
In [10]: ax = df.groupby('day_of_week').agg({'hits':'sum'}).plot.bar(figsize=(6,4))
         ax.set_xticklabels(['Monday', 'Tuesday', 'Wednesday', 'Thursday', 'Friday','Saturday'
         plt.ylabel('hits')
         plt.show()
```

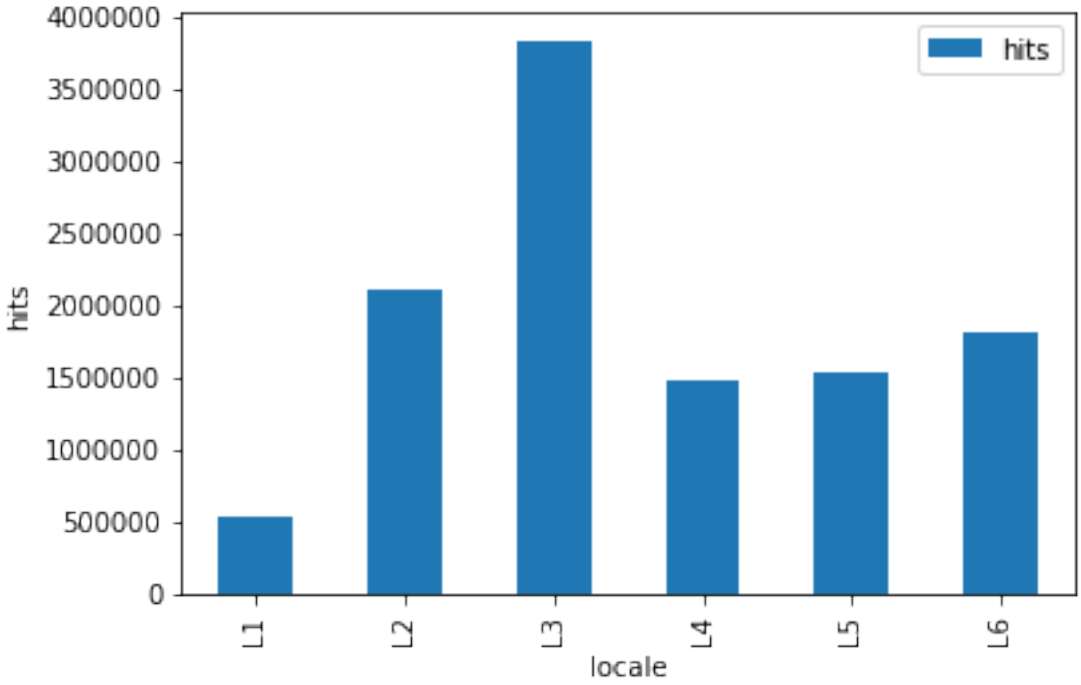



```
In [11]: ax = sns.countplot(x='day_of_week',data=df, palette='hls')
         ax.set_xticklabels(['Monday', 'Tuesday', 'Wednesday', 'Thursday', 'Friday','Saturday'
         plt.ylabel('Frequency')
         plt.show()
```

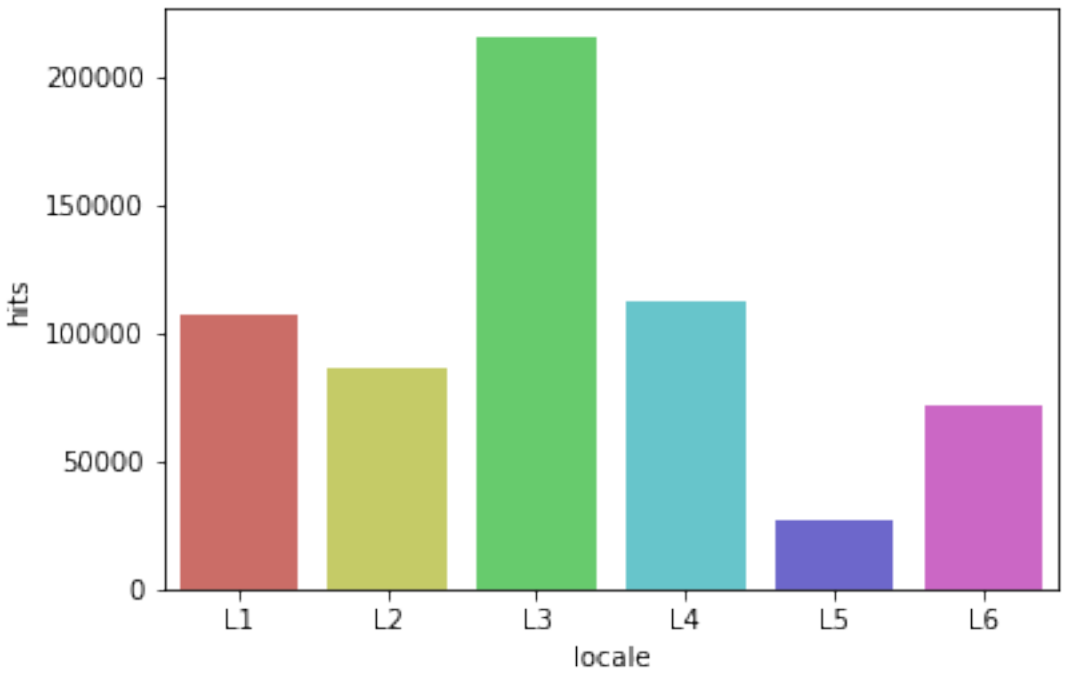


L3 has highest frequency as well as highest no of hits. Of the rest L1 has second highest frequency but lowest hits.

```
In [12]: df.groupby('locale').agg({'hits':'sum'}).plot.bar(figsize=(6,4))
         plt.ylabel('hits')
         plt.show()
```

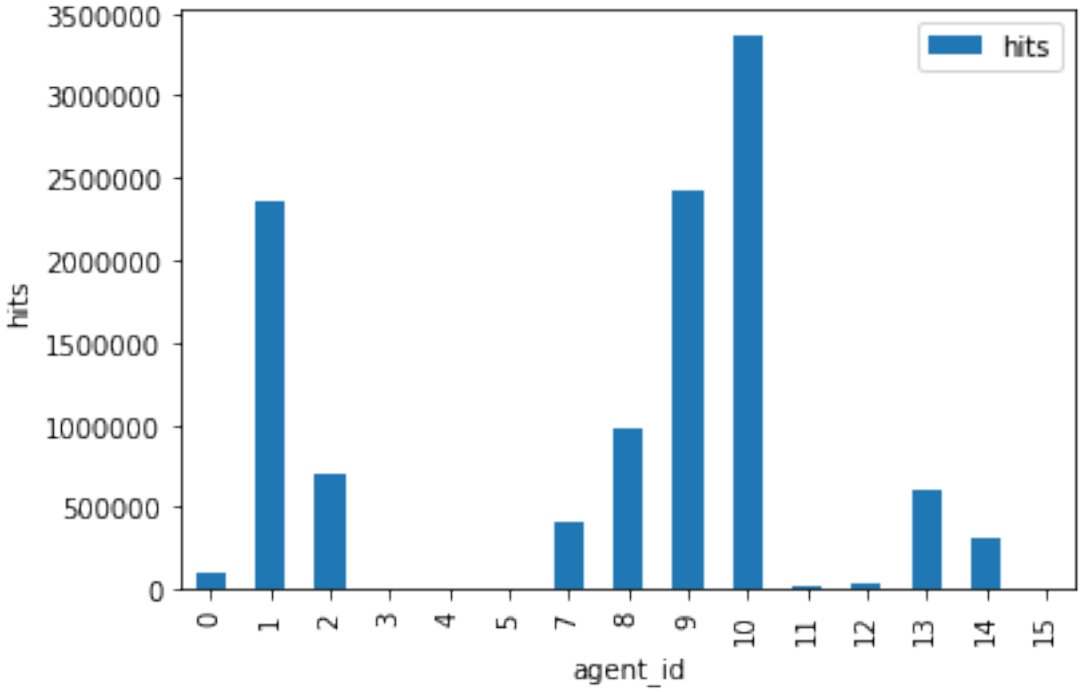


In [13]:
```
ax = sns.countplot(x='locale',data=df, palette='hls')
ax.set_xticklabels(['L1', 'L2', 'L3', 'L4', 'L5','L6'])
plt.ylabel('Frequency')
plt.show()
```

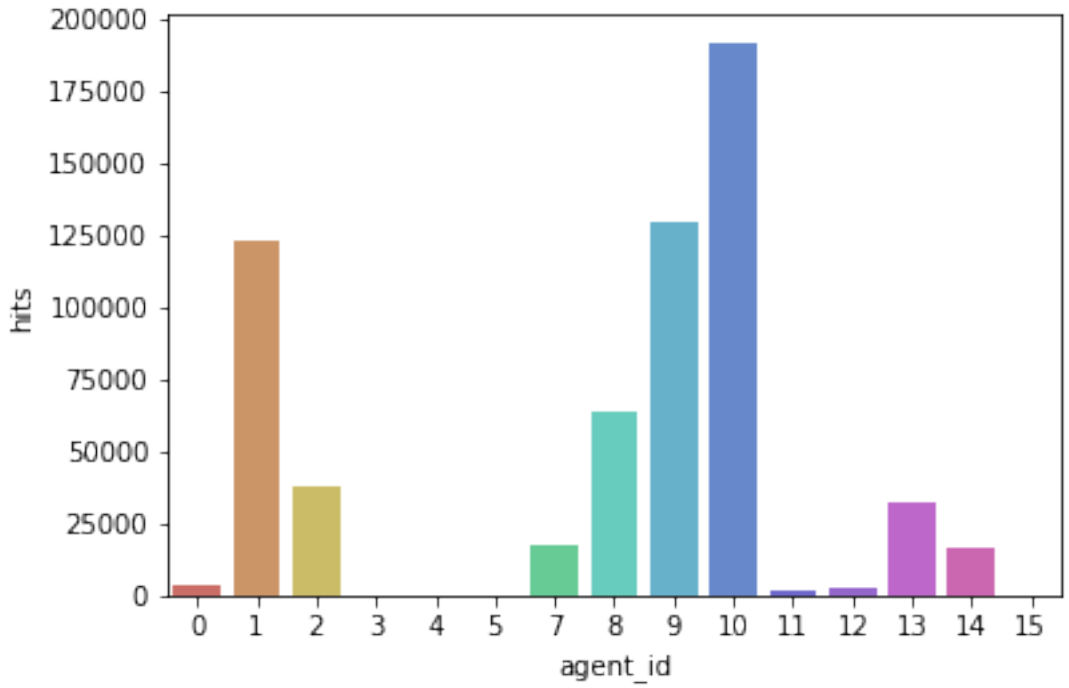


Agent 10 has highest hits as well as highest frequency in the data. Seems other agents frequency is proportional to the hits received.

```
In [14]: df.groupby('agent_id').agg({'hits':'sum'}).plot.bar(figsize=(6,4))
         plt.ylabel('hits')
         plt.show()
```

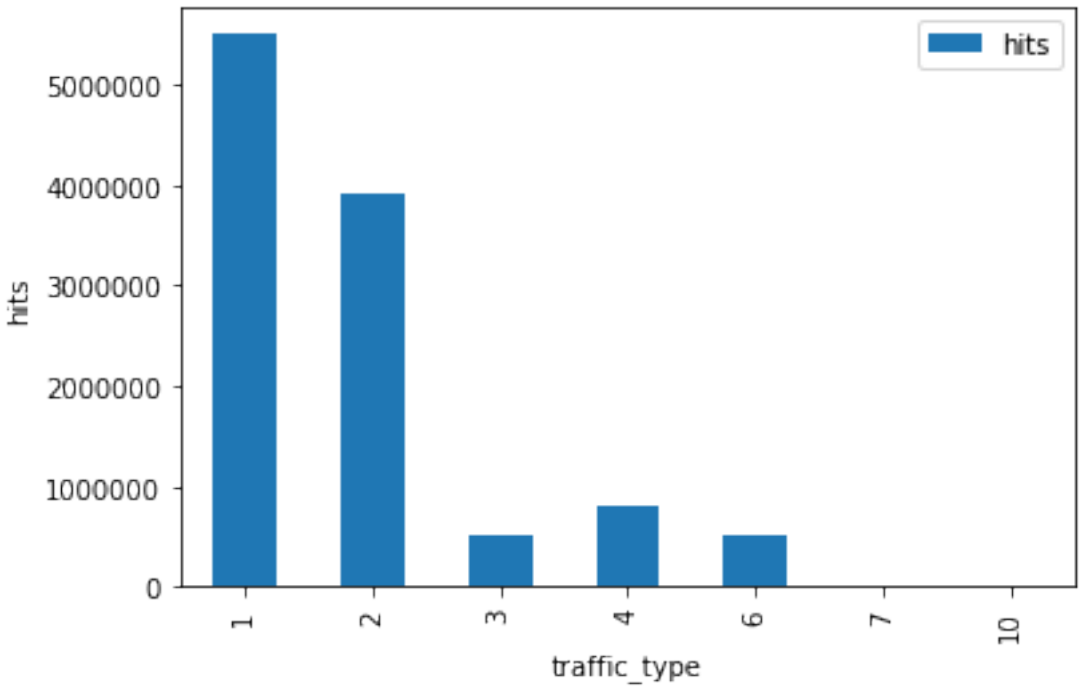



```
In [15]: sns.countplot(x='agent_id',data=df, palette='hls')
         plt.ylabel('Frequency')
         plt.show()
```

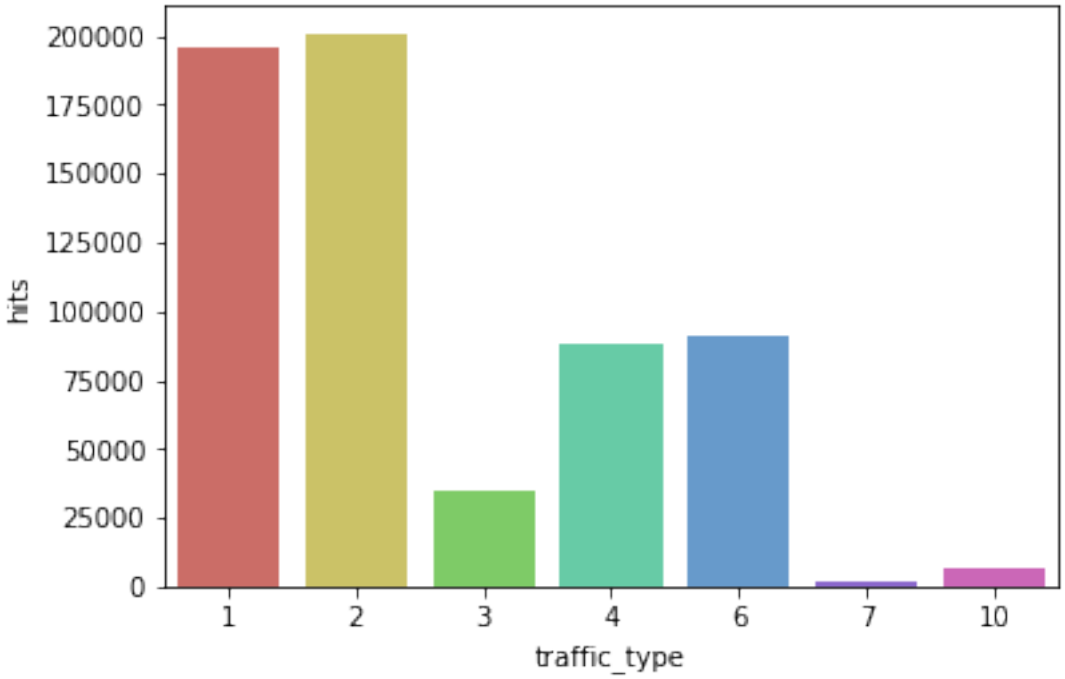


Traffic_type 2 has highest frequency, though Traffic_type 1 has highest hits.

```
In [16]: df.groupby('traffic_type').agg({'hits':'sum'}).plot.bar(figsize=(6,4))
         plt.ylabel('hits')
         plt.show()
```

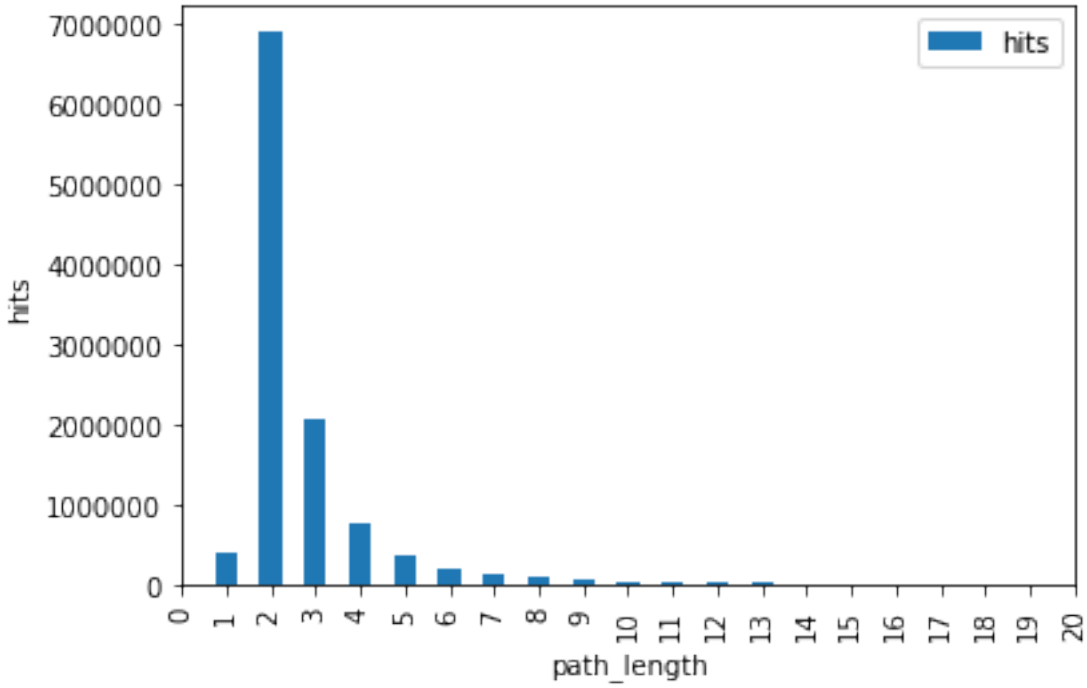


```
In [17]: sns.countplot(x='traffic_type',data=df, palette='hls')
         plt.ylabel('Frequency')
         plt.show()
```

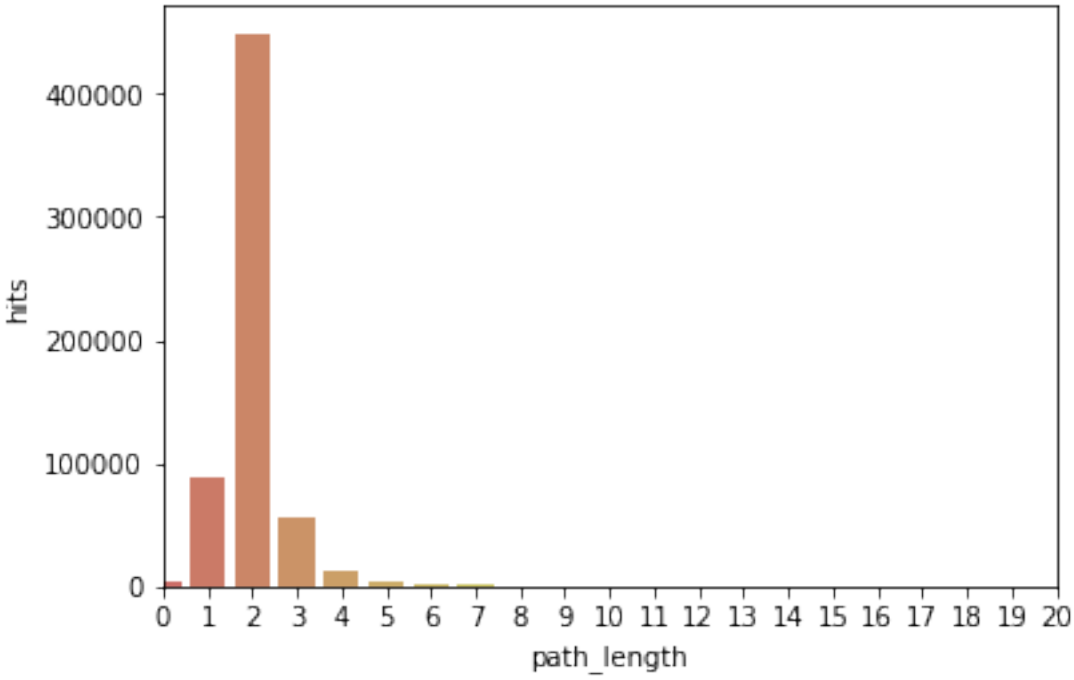


Looks like the Path_length of 2 has higher frequency as well as hiher hits.

```
In [18]: df.groupby('path_length').agg({'hits':'sum'}).plot.bar(figsize=(6,4))
         plt.xlim((0,20))
         plt.ylabel('hits')
         plt.show()
```



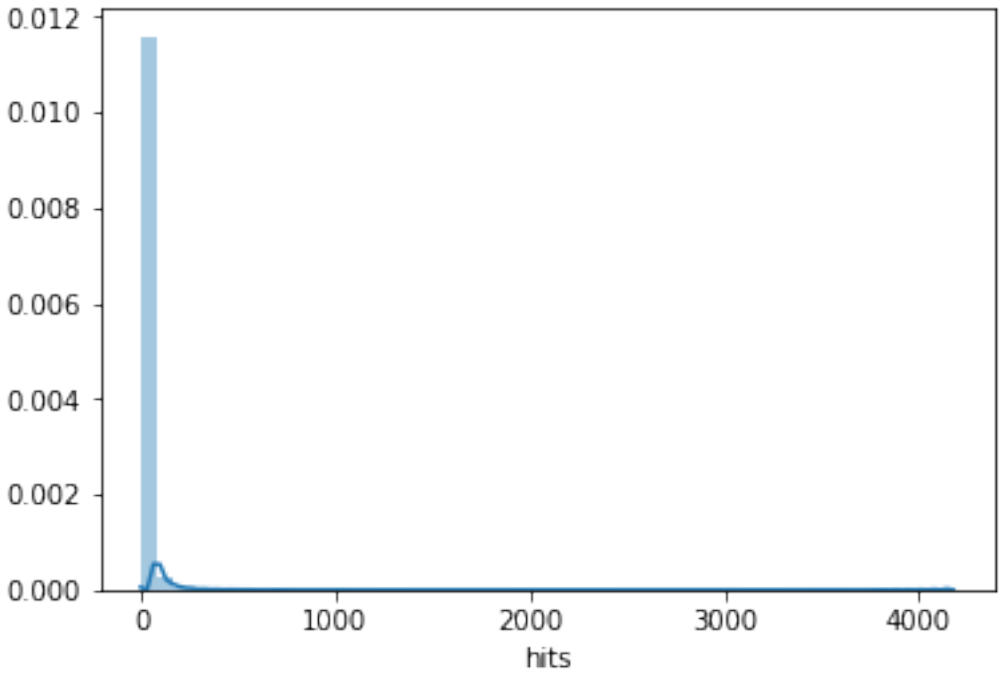
In [19]:
```
sns.countplot(x='path_length',data=df, palette='hls')
plt.ylabel('Frequency')
plt.xlim((0,20))
plt.show()
```



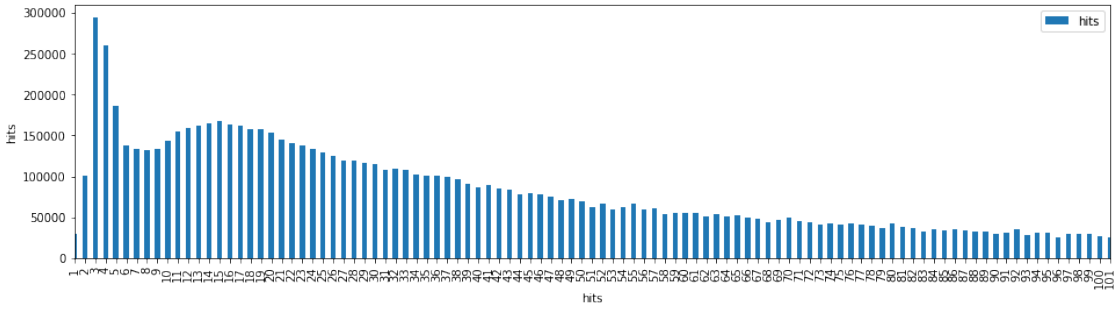
The distribution of hits ranges from 0 to 4000+, which means a lot of variance. The hit size of 3 is more frequent.

```
In [20]: sns.distplot(df['hits'])
         plt.show()
```

```
/Users/raghuramkalyanam/anaconda/lib/python3.6/site-packages/scipy/stats/stats.py:1706: FutureW
  return np.add.reduce(sorted[indexer] * weights, axis=axis) / sumval
/Users/raghuramkalyanam/anaconda/lib/python3.6/site-packages/matplotlib/axes/_axes.py:6462: Use
  warnings.warn("The 'normed' kwarg is deprecated, and has been "
```

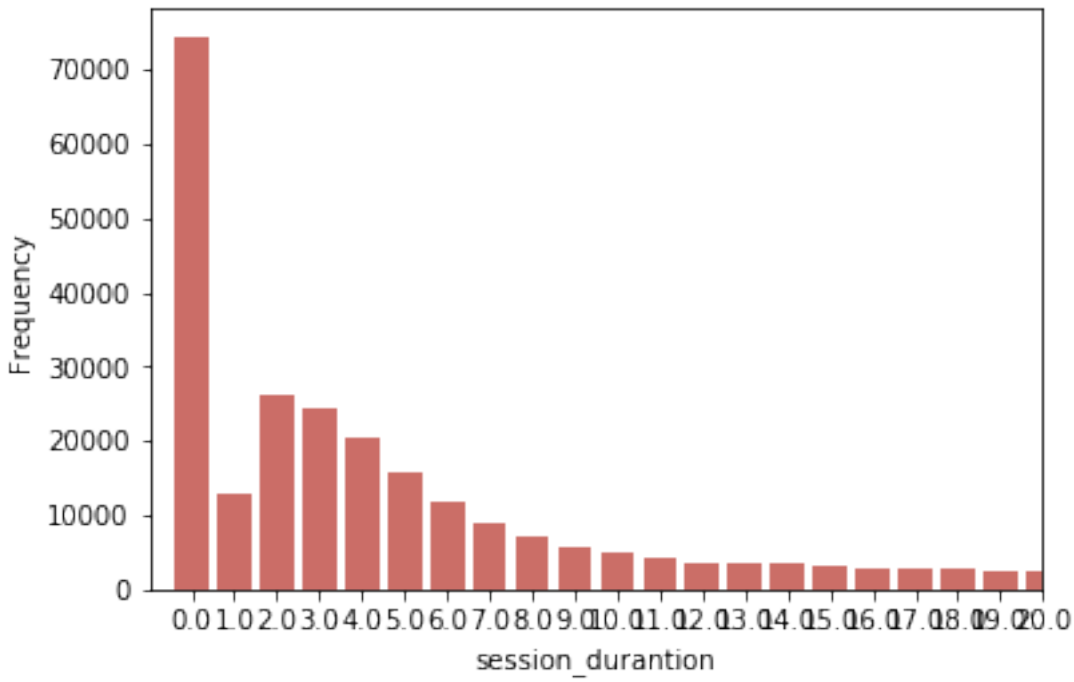



```
In [21]: df.groupby('hits').agg({'hits':'sum'}).plot.bar(figsize=(16,4))
         plt.xlim((0,100))
         plt.ylabel('hits')
         plt.show()
```

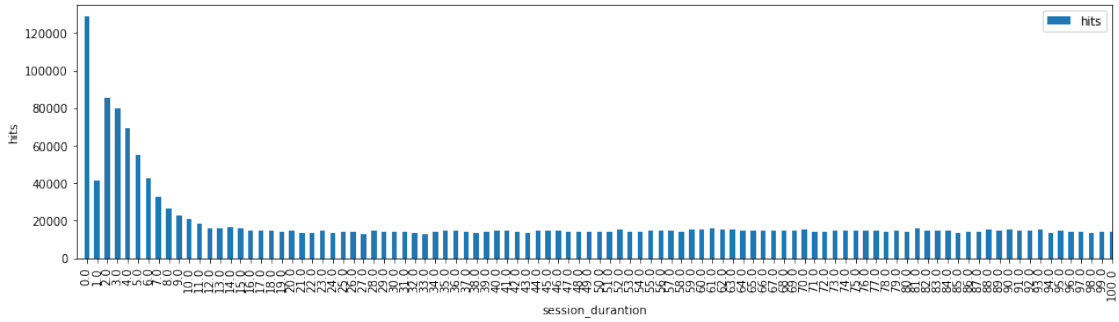


It seems the `session_durantion` has highest frequency at near zero, and also highest hits.

```
In [27]: sns.countplot(x='session_durantion',data=df, palette='hls')
         plt.ylabel('Frequency')
         plt.xlim((-1,20))
         plt.show()
```




```
In [26]: df.groupby('session_durantion').agg({'hits':'sum'}).plot.bar(figsize=(16,4))
         plt.xlim((-1,100))
         plt.ylabel('hits')
         plt.show()
```



The correlation of each feature with the dependent variable. Looks like `path_length` is a good feature. Though `traffic_type` shows considerable correlation, it is categorical.

```
In [23]: df.corr().iloc[:,-4:-3]
```

Out[23]:

	hits
row_num	0.001905
hour_of_day	-0.007967
agent_id	-0.012523
entry_page	-0.032017
traffic_type	-0.201205
session_durantion	0.245530
hits	1.000000
path_length	0.402318
path_imp	0.099270
entry_page_imp	-0.049214

Getting dummies for all the categorical variables.

```
In [5]: df.drop(columns = ['entry_page','path_id_set'],inplace = True )

        df = pd.get_dummies(df, prefix = ['locale','day_of_week','agent_id','traffic_type'], c
```

```
In [24]: #import numpy as np
         #df['log_session_durantion'] =df['session_durantion'].apply(np.log)
         #df['log_session_durantion'] = df['log_session_durantion'].replace(-np.inf,0)

         df = df [['row_num', 'hour_of_day','session_durantion','path_length',
                   'path_imp', 'entry_page_imp', 'locale_L1', 'locale_L2', 'locale_L3',
                   'locale_L4', 'locale_L5', 'locale_L6','day_of_week_Monday',
                    'day_of_week_Tuesday','day_of_week_Wednesday','day_of_week_Thursday',
                    'day_of_week_Friday','day_of_week_Saturday', 'day_of_week_Sunday',
                   'agent_id_0', 'agent_id_1', 'agent_id_2', 'agent_id_3', 'agent_id_4',
                   'agent_id_5', 'agent_id_7', 'agent_id_8', 'agent_id_9', 'agent_id_10',
                   'agent_id_11', 'agent_id_12', 'agent_id_13', 'agent_id_14',
                   'agent_id_15', 'traffic_type_1', 'traffic_type_2', 'traffic_type_3',
                   'traffic_type_4', 'traffic_type_6', 'traffic_type_7',
                   'traffic_type_10','hits']]
```

More information is provided in the python files. The final result achieved is around MSE of 31.7 hits on the validation data.