

# Resultados-paper2

June 1, 2020

## 1 Contextual Meta-Bandit for Recommender Systems Selection

```
[1]: import sys, os
import plotly.graph_objects as go
import numpy as np

sys.path.insert(0, "/media/workspace/DeepFood/deep-reco-gym/tools/eval_viz")
import pandas as pd
import argparse
import copy
import numpy as np
import os
import random
import json
from pandas.io.json import json_normalize
from app import fetch_interaction_results_path, load_all_interaction_metrics
from app import load_interactions_params as load_interactions_params2,
↳PATH_EVAL_REINFORCEMENT
from plot import plot_line_interaction, plot_exploration_arm, get_colors,
↳confidence
import pandas as pd
import argparse
import copy
import numpy as np
import streamlit as st
import seaborn as sns
sns.set(style="darkgrid")
#sys.path.insert(0, os.path.dirname(__file__))
import matplotlib.pyplot as plt
from app import load_data_metrics, load_eval_params, filter_df,
↳fetch_results_path
```

```
[2]: models_and_legend = {
    "___remote_": ["bandit_policy", "obs"],
}
path = PATH_EVAL_REINFORCEMENT
```

```
[3]: models_and_legend
```

```
[3]: {'__remote_': ['bandit_policy', 'obs']}
```

```
[4]: def list_paths_per_model(input_path):
    models = []

    for model, legend in models_and_legend.items():
        #print(model)
        #print(legend)
        for root, dirs, files in os.walk(input_path):
            if '/results' in root and 'Interaction' in root:
                for d in dirs:
                    #print(os.path.join(root, d))
                    if model in d:
                        models.append(os.path.join(root, d))

    return models

def load_interactions_params(interactions):
    if len(interactions) == 0:
        return pd.DataFrame()

    dfs = []

    for model in interactions:

        file_path = os.path.join(model, 'params.json')
        data = []

        #try:
        with open(file_path) as json_file:
            d = json.load(json_file)
            data.append(d)

            df = pd.DataFrame.from_dict(json_normalize(data), orient='columns')

            #except:
            # df = pd.DataFrame()

            df['interaction'] = model
            dfs.append(df)

    return pd.concat(dfs)

def load_data_interactions_metrics(path, sample_size = 10000):
    random.seed(42)
```

```

file      = os.path.join(path, 'sim-datalog.csv')

# Count the lines
num_lines = sum(1 for l in open(file)) - 1

# Sample size - in this case ~10%
size = np.min([sample_size, num_lines])#int(num_lines / 10)

# The row indices to skip - make sure 0 is not included to keep the header!
skip_idx  = sorted(random.sample(range(1, num_lines), num_lines - size))
idx       = list(set(list(range(num_lines))) - set(skip_idx))

df        = pd.read_csv(file, skiprows=skip_idx)

df        = pd.read_csv(file)#.reset_index()
idx       = list(range(len(df)))

df['idx'] = sorted(idx)
df        = df.sort_values("idx")
return df

def get_metrics_reward(bandits):
    data    = []
    for i, p in enumerate(bandits):
        df_metrics = load_data_interactions_metrics(p)
        r_mean     = df_metrics.reward.mean()
        r_reward    = df_metrics.reward.sum()
        data.append((i, r_mean, r_reward))
    df_metrics = pd.DataFrame(data, columns=['idx', 'r_mean', 'r_reward']).
    ↪set_index('idx')
    return df_metrics

def group_metrics(df):
    df_g_metrics = df.groupby('bandit').agg({'r_mean': ['mean', 'std'],
    ↪'r_reward': ['mean', 'std', 'count'], 'model': 'first' })
    df_g_metrics.columns = df_g_metrics.columns.map(lambda x: '|'.join([str(i)
    ↪for i in x]))
    return df_g_metrics

result_paths = list_paths_per_model(path)
#result_paths

```

```
[5]: fetch_results_path()
```

```
[5]: {}
```

## 1.1 Filter and Group Results per Bandit

```
[6]: df_params = load_interactions_params(result_paths)
df_params.head()
```

/home/marlesson/anaconda3/envs/deep-reco-gym/lib/python3.6/site-packages/ipykernel\_launcher.py:39: FutureWarning:

Sorting because non-concatenation axis is not aligned. A future version of pandas will change to not sort by default.

To accept the future behavior, pass 'sort=False'.

To retain the current behavior and silence the warning, pass 'sort=True'.

```
[6]: balance_fields      bandit_policy  bandit_policy_params.c \
0 []      remote_contextual_softmax      NaN
0 []      remote_contextual_epsilon_greedy NaN
0 []      remote_contextual_epsilon_greedy NaN
0 []      remote_contextual_epsilon_greedy NaN
0 []      remote_contextual_epsilon_greedy NaN

      bandit_policy_params.endpoints \
0 [http://localhost:5001/rank, http://localhost:5003/rank,
http://localhost:5004/rank, http://localhost:5005/rank]
0 [http://localhost:5001/rank, http://localhost:5003/rank,
http://localhost:5004/rank, http://localhost:5005/rank]
0 [http://localhost:5001/rank, http://localhost:5003/rank,
http://localhost:5004/rank, http://localhost:5005/rank]
0 [http://localhost:5001/rank, http://localhost:5003/rank,
http://localhost:5004/rank, http://localhost:5005/rank]
0 [http://localhost:5001/rank, http://localhost:5003/rank,
http://localhost:5004/rank, http://localhost:5005/rank]

      bandit_policy_params.epsilon  bandit_policy_params.logit_multiplier \
0 NaN      10.0
0 0.10      NaN
0 0.05      NaN
0 0.05      NaN
0 0.20      NaN

      bandit_policy_params.window_reward  batch_size dataset_split_method device \
0 NaN      500      time      cuda
0 NaN      500      time      cuda
0 NaN      500      time      cuda
0 NaN      500      time      cuda
```

	0 NaN		500		time		cuda
	...	seed	session_test_size	split_index	test_size	test_split_type	\
0	...	13	0.1	0	0.0	time	
0	...	12	0.1	0	0.0	time	
0	...	13	0.1	0	0.0	time	
0	...	11	0.1	0	0.0	time	
0	...	10	0.1	0	0.0	time	
		use_sampling_in_validation		user_column	user_idx_column	val_size	\
0	False			account_id	account_idx	0.0	
0	False			account_id	account_idx	0.0	
0	False			account_id	account_idx	0.0	
0	False			account_id	account_idx	0.0	
0	False			account_id	account_idx	0.0	
		val_split_type					
0	time						
0	time						
0	time						
0	time						
0	time						

[5 rows x 47 columns]

```
[7]: df_params.obs.unique()
```

```
[7]: array(['[Contextual]Softmax-10 13', '[CONTEXTUAL]e-greedy-0.05 12',
        '[CONTEXTUAL]e-greedy-0.05 13', '[CONTEXTUAL]e-greedy-0.05 11',
        '[CONTEXTUAL]e-greedy-0.05 10', '[MAB]e-greedy-0.05 16',
        '[MAB]UCB-5 11', '[MAB]UCB-10-10000 2', '[MAB]UCB-1-10000 1',
        '[MAB]UCB-10 11', '[MAB]e-greedy-0.2 12',
        '[Contextual]Softmax-50 14', '[Contextual]Softmax-100 11',
        '[MAB]e-greedy-0.2 10', '[MAB]e-greedy-0.2 14',
        '[MAB]e-greedy-0.1 10', '[Contextual]Softmax-500 10',
        '[CONTEXTUAL]e-greedy-0.05 14', '[MAB]e-greedy-0.1 16',
        '[MAB]e-greedy-0.05 11', '[Contextual]Softmax-10 16',
        '[Contextual]Softmax-500 14', '[MAB]e-greedy-0.05 12',
        '[Contextual]Softmax-500 11', '[MAB]UCB-1 11', 'CDAE',
        '[Contextual]Softmax-50 13', '[MAB]e-greedy-0.2 13',
        '[Contextual]Softmax-10 11', '[MAB]e-greedy-0.05 10',
        'MostPopular', '[Contextual]Softmax-50 11',
        '[Contextual]Softmax-50 10', '[Contextual]Softmax-10 14',
        'MatrixFactorization', 'teste', '[Contextual]Softmax-10 10',
        '[MAB]UCB-5 12', '[MAB]e-greedy-0.05 13',
        '[Contextual]Softmax-100 15', '[CONTEXTUAL]e-greedy-0.05 16',
        '[CONTEXTUAL]e-greedy-0.05 15', '[Contextual]Softmax-500 15',
```

```
'[MAB]e-greedy-0.1 14', '[Contextual]Softmax-50 12',
'[MAB]e-greedy-0.05 15', '[MAB]UCB-5 10', '[MAB]e-greedy-0.05 14',
'[Contextual]Softmax-500 12', '[MAB]e-greedy-0.1 13',
'[Contextual]Softmax-500 13', '[MAB]e-greedy-0.1 12',
'[Contextual]Softmax-100 10', '[MAB]e-greedy-0.1 15',
'[Contextual]Softmax-100 14', '[MAB]e-greedy-0.2 15',
'[MAB]e-greedy-0.2 16', '[Contextual]Softmax-100 12',
'[MAB]e-greedy-0.1 11', '[Contextual]Softmax-50 15',
'[MAB]UCB-1 12', '[MAB]UCB-10 10', 'CVAE',
'[MAB]e-greedy-0.2 11', '[MAB]UCB-5-10000 1', '[MAB]UCB-1 10',
'[Contextual]Softmax-10 15', 'Random', '[Contextual]Softmax-10 12',
'[Contextual]Softmax-100 13']], dtype=object)
```

```
[8]: df_params['obs'].apply(lambda x: " ".join(x.split(" ")[:-1]).strip()).unique()
```

```
[8]: array(['[Contextual]Softmax-10', '[CONTEXTUAL]e-greedy-0.05',
'[MAB]e-greedy-0.05', '[MAB]UCB-5', '[MAB]UCB-10-10000',
'[MAB]UCB-1-10000', '[MAB]UCB-10', '[MAB]e-greedy-0.2',
'[Contextual]Softmax-50', '[Contextual]Softmax-100',
'[MAB]e-greedy-0.1', '[Contextual]Softmax-500', '[MAB]UCB-1', '',
'[MAB]UCB-5-10000'], dtype=object)
```

```
[9]: df_params
df_params['observation'] = df_params['bandit_policy_params.epsilon'].
    ↳ apply(str)+df_params['obs']# .apply(lambda x: " ".join(x.split(" ")[:-2]))
df_params['observation'] = df_params['observation'].apply(lambda x: " ".join(x.
    ↳ split(" ")[:-1]) if len(x.split(" ")) > 1 else x)
df_params['observation'].unique()
```

```
[9]: array(['nan[Contextual]Softmax-10', '0.1[CONTEXTUAL]e-greedy-0.05',
'0.05[CONTEXTUAL]e-greedy-0.05', '0.2[CONTEXTUAL]e-greedy-0.05',
'0.05[MAB]e-greedy-0.05', 'nan[MAB]UCB-5 ',
'nan[MAB]UCB-10-10000 ', 'nan[MAB]UCB-1-10000 ', 'nan[MAB]UCB-10 ',
'0.2[MAB]e-greedy-0.2', 'nan[Contextual]Softmax-50',
'nan[Contextual]Softmax-100', '0.1[MAB]e-greedy-0.1',
'nan[Contextual]Softmax-500', 'nan[MAB]UCB-1 ', 'nanCDAE',
'nanMostPopular', 'nanMatrixFactorization', '0.05teste', 'nanCVAE',
'nan[MAB]UCB-5-10000 ', 'nanRandom'], dtype=object)
```

```
[10]: list_bandits = df_params.groupby(["bandit_policy",
    ↳ "observation"]['interaction'].apply(list).reset_index()
list_bandits['name'] = list_bandits.bandit_policy.map(str) + ' ' +
    ↳ list_bandits.observation.map(str)
list_bandits['name'] = list_bandits['name'].apply(lambda x: x.replace("fixed_",
    ↳ "", "").replace(" ", ""))
list_bandits['model'] = list_bandits.interaction.apply(lambda l: l[np.random.
    ↳ randint(0, len(l))])
```

```
list_bandits['model_list'] = list_bandits.interaction
list_bandits
```

```
[10]:
bandit_policy      observation \
0  remote          nanCDAE
1  remote          nanCVAE
2  remote          nanMatrixFactorization
3  remote          nanMostPopular
4  remote          nanRandom
5  remote_contextual_epsilon_greedy 0.05[CONTEXTUAL]e-greedy-0.05
6  remote_contextual_epsilon_greedy 0.1[CONTEXTUAL]e-greedy-0.05
7  remote_contextual_epsilon_greedy 0.2[CONTEXTUAL]e-greedy-0.05
8  remote_contextual_softmax      nan[Contextual]Softmax-10
9  remote_contextual_softmax      nan[Contextual]Softmax-100
10 remote_contextual_softmax      nan[Contextual]Softmax-50
11 remote_contextual_softmax      nan[Contextual]Softmax-500
12 remote_epsilon_greedy          0.05[MAB]e-greedy-0.05
13 remote_epsilon_greedy          0.05teste
14 remote_epsilon_greedy          0.1[MAB]e-greedy-0.1
15 remote_epsilon_greedy          0.2[MAB]e-greedy-0.2
16 remote_ucb                    nan[MAB]UCB-1
17 remote_ucb                    nan[MAB]UCB-1-10000
18 remote_ucb                    nan[MAB]UCB-10
19 remote_ucb                    nan[MAB]UCB-10-10000
20 remote_ucb                    nan[MAB]UCB-5
21 remote_ucb                    nan[MAB]UCB-5-10000

interaction \
0  [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
   _remote___endpoints_____68e9460cc6]
1  [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
   _remote___endpoints_____d73aad920]
2  [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
   _remote___endpoints_____d2667d3c0b]
3  [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
   _remote___endpoints_____5dab9c3b0a]
4  [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
   _remote___endpoints_____44e07863e7]
5  [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
   _remote_contextua___endpoints_____09ec6475d3, output/interaction/EnsambleMABInt
   eraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____6d7
   92a3ed1, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteractio
   n___remote_contextua___endpoints_____afb131bbc0, output/interaction/EnsambleMA
   BInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____
   _675b43b6a5, output/interaction/EnsambleMABInteraction/results/EnsambleMABIntera
   ction___remote_contextua___endpoints_____2c656f2636, output/interaction/Ensambl
   eMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_
```

```

4184b0299f, output/interaction/EnsambleMABInteraction/results/EnsambleMABInt
eraction___remote_contextua___endpoints_____a0d520e892]
6 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
_remote_contextua___endpoints_____5091adba5a, output/interaction/EnsambleMABInt
eraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____d08
250e913, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteractio
n___remote_contextua___endpoints_____5c5906d549, output/interaction/EnsambleMA
BInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____
_8a7bb007f0, output/interaction/EnsambleMABInteraction/results/EnsambleMABIntera
ction___remote_contextua___endpoints_____3ccb54e1a4, output/interaction/Ensambl
eMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_
_____03a780dcdf, output/interaction/EnsambleMABInteraction/results/EnsambleMABIn
teraction___remote_contextua___endpoints_____e0b5f34e99]
7 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
_remote_contextua___endpoints_____6e9c4bdd6a, output/interaction/EnsambleMABInt
eraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____5fc
531976b, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteractio
n___remote_contextua___endpoints_____7ac2a172ad, output/interaction/EnsambleMA
BInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____
_43a64bfd00, output/interaction/EnsambleMABInteraction/results/EnsambleMABIntera
ction___remote_contextua___endpoints_____f685f4e615, output/interaction/Ensambl
eMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_
_____5afaccebb8, output/interaction/EnsambleMABInteraction/results/EnsambleMABIn
teraction___remote_contextua___endpoints_____433956de17]
8 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
_remote_contextua___endpoints_____3615524b61, output/interaction/EnsambleMABInt
eraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____074
1e343b3, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteractio
n___remote_contextua___endpoints_____1b016623d3, output/interaction/EnsambleMA
BInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____
_924996f8b7, output/interaction/EnsambleMABInteraction/results/EnsambleMABIntera
ction___remote_contextua___endpoints_____c6345e61c1, output/interaction/Ensambl
eMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_
_____64a11b890d, output/interaction/EnsambleMABInteraction/results/EnsambleMABIn
teraction___remote_contextua___endpoints_____d17a43231d]
9 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
_remote_contextua___endpoints_____fdcd2bc277, output/interaction/EnsambleMABInt
eraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____4f2
a116ad0, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteractio
n___remote_contextua___endpoints_____40ea7b2e43, output/interaction/EnsambleMA
BInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____
_56033066b8, output/interaction/EnsambleMABInteraction/results/EnsambleMABIntera
ction___remote_contextua___endpoints_____f8ceb8586d, output/interaction/Ensambl
eMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_
_____8842e01077]
10 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
_remote_contextua___endpoints_____c8c45cf975, output/interaction/EnsambleMABInt

```



eraction/results/EnsambleMABInteraction\_\_\_remote\_contextua\_\_\_endpoints\_\_\_\_\_ffe  
 1f228b7, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteractio  
 n\_\_\_remote\_contextua\_\_\_endpoints\_\_\_\_\_9925bfe8b0, output/interaction/EnsambleMA  
 BInteraction/results/EnsambleMABInteraction\_\_\_remote\_contextua\_\_\_endpoints\_\_\_\_\_4a73914b3c, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteractio  
 ction\_\_\_remote\_contextua\_\_\_endpoints\_\_\_\_\_3f58f7cedd, output/interaction/Ensamble  
 leMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_contextua\_\_\_endpoints\_  
 \_\_\_\_\_22679c55bd]  
 11 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_  
 \_remote\_contextua\_\_\_endpoints\_\_\_\_\_a1decdf0c, output/interaction/EnsambleMABInt  
 eraction/results/EnsambleMABInteraction\_\_\_remote\_contextua\_\_\_endpoints\_\_\_\_\_09d  
 6eb1a5c, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteractio  
 n\_\_\_remote\_contextua\_\_\_endpoints\_\_\_\_\_b4089aa1b7, output/interaction/EnsambleMA  
 BInteraction/results/EnsambleMABInteraction\_\_\_remote\_contextua\_\_\_endpoints\_\_\_\_\_8483faf101, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteractio  
 ction\_\_\_remote\_contextua\_\_\_endpoints\_\_\_\_\_83cc906d2c, output/interaction/Ensamble  
 leMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_contextua\_\_\_endpoints\_  
 \_\_\_\_\_d4d6c15e56]  
 12 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_  
 \_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_c76ad64378, output/interaction/EnsambleMABInt  
 eraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_faf  
 bba24ad, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteractio  
 n\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_bb7ec2218b, output/interaction/EnsambleMA  
 BInteraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_92c596a4c7, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteractio  
 ction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_13e254b692, output/interaction/Ensamble  
 leMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_  
 \_\_\_\_\_dd91393907, output/interaction/EnsambleMABInteraction/results/EnsambleMABIn  
 teraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_b42d6ffd47]  
 13 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_  
 \_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_436fbee58a]  
 14 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_  
 \_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_e2ed09fcb3, output/interaction/EnsambleMABInt  
 eraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_095  
 d7a2bfa, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteractio  
 n\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_26a98659b3, output/interaction/EnsambleMA  
 BInteraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_2997aaab26, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteractio  
 ction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_f21e3b0cdb, output/interaction/Ensamble  
 leMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_  
 \_\_\_\_\_34ddf7971c, output/interaction/EnsambleMABInteraction/results/EnsambleMABIn  
 teraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_da2ecff9fd]  
 15 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_  
 \_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_146c3c13b4, output/interaction/EnsambleMABInt  
 eraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_4e3  
 61155b0, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteractio  
 n\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_7ea703bb9b, output/interaction/EnsambleMA

```

BInteraction/results/EnsambleMABInteraction___remote_epsilon_g___endpoints_____
_463311502b, output/interaction/EnsambleMABInteraction/results/EnsambleMABInterac
tion___remote_epsilon_g___endpoints_____992dfd5c53, output/interaction/Ensambl
eMABInteraction/results/EnsambleMABInteraction___remote_epsilon_g___endpoints_
_____29f8333350, output/interaction/EnsambleMABInteraction/results/EnsambleMABIn
teraction___remote_epsilon_g___endpoints_____e629c0a750]
16 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
_remote_ucb___endpoints_____432b72a2ba, output/interaction/EnsambleMABInteracti
on/results/EnsambleMABInteraction___remote_ucb___endpoints_____ad84e1b2a4, out
put/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_
ucb___endpoints_____b3ca04a155]
17 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
_remote_ucb___endpoints_____78b0b601e8]
18 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
_remote_ucb___endpoints_____ed5909cbac, output/interaction/EnsambleMABInteracti
on/results/EnsambleMABInteraction___remote_ucb___endpoints_____7e7848f84c]
19 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
_remote_ucb___endpoints_____c6ad4386c3]
20 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
_remote_ucb___endpoints_____62a6f67423, output/interaction/EnsambleMABInteracti
on/results/EnsambleMABInteraction___remote_ucb___endpoints_____c96b9331ac, out
put/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_
ucb___endpoints_____09f70e856b]
21 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
_remote_ucb___endpoints_____5559c61cfe]

```

name \

```

0 remotenanCDAE
1 remotenanCVAE
2 remotenanMatrixFactorization
3 remotenanMostPopular
4 remotenanRandom
5 remote_contextual_epsilon_greedy0.05[CONTEXTUAL]e-greedy-0.05
6 remote_contextual_epsilon_greedy0.1[CONTEXTUAL]e-greedy-0.05
7 remote_contextual_epsilon_greedy0.2[CONTEXTUAL]e-greedy-0.05
8 remote_contextual_softmaxnan[Contextual]Softmax-10
9 remote_contextual_softmaxnan[Contextual]Softmax-100
10 remote_contextual_softmaxnan[Contextual]Softmax-50
11 remote_contextual_softmaxnan[Contextual]Softmax-500
12 remote_epsilon_greedy0.05[MAB]e-greedy-0.05
13 remote_epsilon_greedy0.05teste
14 remote_epsilon_greedy0.1[MAB]e-greedy-0.1
15 remote_epsilon_greedy0.2[MAB]e-greedy-0.2
16 remote_ucbnan[MAB]UCB-1
17 remote_ucbnan[MAB]UCB-1-10000
18 remote_ucbnan[MAB]UCB-10
19 remote_ucbnan[MAB]UCB-10-10000

```

20 remote\_ucbnan[MAB]UCB-5  
21 remote\_ucbnan[MAB]UCB-5-10000

```
                                model \
0  output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote__endpoints_____68e9460cc6
1  output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote__endpoints_____d73aad920
2  output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote__endpoints_____d2667d3c0b
3  output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote__endpoints_____5dab9c3b0a
4  output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote__endpoints_____44e07863e7
5  output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote_contextua__endpoints_____675b43b6a5
6  output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote_contextua__endpoints_____5091adba5a
7  output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote_contextua__endpoints_____433956de17
8  output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote_contextua__endpoints_____d17a43231d
9  output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote_contextua__endpoints_____40ea7b2e43
10 output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote_contextua__endpoints_____ffe1f228b7
11 output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote_contextua__endpoints_____83cc906d2c
12 output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote_epsilon_g__endpoints_____fafbba24ad
13 output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote_epsilon_g__endpoints_____436fbee58a
14 output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote_epsilon_g__endpoints_____f21e3b0cdb
15 output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote_epsilon_g__endpoints_____e629c0a750
16 output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote_ucb__endpoints_____ad84e1b2a4
17 output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote_ucb__endpoints_____78b0b601e8
18 output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote_ucb__endpoints_____7e7848f84c
19 output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote_ucb__endpoints_____c6ad4386c3
20 output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote_ucb__endpoints_____c96b9331ac
21 output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
```

remote\_ucb\_\_\_endpoints\_\_\_\_\_5559c61cfe

model\_list

```
0 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
remote___endpoints_____68e9460cc6]
1 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
remote___endpoints_____d73aad920]
2 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
remote___endpoints_____d2667d3c0b]
3 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
remote___endpoints_____5dab9c3b0a]
4 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
remote___endpoints_____44e07863e7]
5 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
remote_contextua___endpoints_____09ec6475d3, output/interaction/EnsambleMABInt
eraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____6d7
92a3ed1, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteractio
n___remote_contextua___endpoints_____afb131bbc0, output/interaction/EnsambleMA
BInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____
675b43b6a5, output/interaction/EnsambleMABInteraction/results/EnsambleMABIntera
ction___remote_contextua___endpoints_____2c656f2636, output/interaction/Ensambl
eMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_
_____4184b0299f, output/interaction/EnsambleMABInteraction/results/EnsambleMABIn
teraction___remote_contextua___endpoints_____a0d520e892]
6 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
remote_contextua___endpoints_____5091adba5a, output/interaction/EnsambleMABInt
eraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____d08
250e913, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteractio
n___remote_contextua___endpoints_____5c5906d549, output/interaction/EnsambleMA
BInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____
8a7bb007f0, output/interaction/EnsambleMABInteraction/results/EnsambleMABIntera
ction___remote_contextua___endpoints_____3ccb54e1a4, output/interaction/Ensambl
eMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_
_____03a780dcdf, output/interaction/EnsambleMABInteraction/results/EnsambleMABIn
teraction___remote_contextua___endpoints_____e0b5f34e99]
7 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
remote_contextua___endpoints_____6e9c4bdd6a, output/interaction/EnsambleMABInt
eraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____5fc
531976b, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteractio
n___remote_contextua___endpoints_____7ac2a172ad, output/interaction/EnsambleMA
BInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____
43a64bfd00, output/interaction/EnsambleMABInteraction/results/EnsambleMABIntera
ction___remote_contextua___endpoints_____f685f4e615, output/interaction/Ensambl
eMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_
_____5afaccebb8, output/interaction/EnsambleMABInteraction/results/EnsambleMABIn
teraction___remote_contextua___endpoints_____433956de17]
8 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___
```

\_remote\_contextua\_\_endpoints\_\_\_\_\_3615524b61, output/interaction/EnsambleMABInt  
 eraction/results/EnsambleMABInteraction\_\_\_remote\_contextua\_\_endpoints\_\_\_\_\_074  
 1e343b3, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteractio  
 n\_\_\_remote\_contextua\_\_endpoints\_\_\_\_\_1b016623d3, output/interaction/EnsambleMA  
 BInteraction/results/EnsambleMABInteraction\_\_\_remote\_contextua\_\_endpoints\_\_\_\_\_  
 \_924996f8b7, output/interaction/EnsambleMABInteraction/results/EnsambleMABIntera  
 ction\_\_\_remote\_contextua\_\_endpoints\_\_\_\_\_c6345e61c1, output/interaction/Ensambl  
 eMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_contextua\_\_endpoints\_  
 \_\_\_\_\_64a11b890d, output/interaction/EnsambleMABInteraction/results/EnsambleMABIn  
 teraction\_\_\_remote\_contextua\_\_endpoints\_\_\_\_\_d17a43231d]  
 9 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_  
 \_remote\_contextua\_\_endpoints\_\_\_\_\_fdcd2bc277, output/interaction/EnsambleMABInt  
 eraction/results/EnsambleMABInteraction\_\_\_remote\_contextua\_\_endpoints\_\_\_\_\_4f2  
 a116ad0, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteractio  
 n\_\_\_remote\_contextua\_\_endpoints\_\_\_\_\_40ea7b2e43, output/interaction/EnsambleMA  
 BInteraction/results/EnsambleMABInteraction\_\_\_remote\_contextua\_\_endpoints\_\_\_\_\_  
 \_56033066b8, output/interaction/EnsambleMABInteraction/results/EnsambleMABIntera  
 ction\_\_\_remote\_contextua\_\_endpoints\_\_\_\_\_f8ceb8586d, output/interaction/Ensambl  
 eMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_contextua\_\_endpoints\_  
 \_\_\_\_\_8842e01077]  
 10 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_  
 \_remote\_contextua\_\_endpoints\_\_\_\_\_c8c45cf975, output/interaction/EnsambleMABInt  
 eraction/results/EnsambleMABInteraction\_\_\_remote\_contextua\_\_endpoints\_\_\_\_\_ffe  
 1f228b7, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteractio  
 n\_\_\_remote\_contextua\_\_endpoints\_\_\_\_\_9925bfe8b0, output/interaction/EnsambleMA  
 BInteraction/results/EnsambleMABInteraction\_\_\_remote\_contextua\_\_endpoints\_\_\_\_\_  
 \_4a73914b3c, output/interaction/EnsambleMABInteraction/results/EnsambleMABIntera  
 ction\_\_\_remote\_contextua\_\_endpoints\_\_\_\_\_3f58f7cedd, output/interaction/Ensambl  
 eMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_contextua\_\_endpoints\_  
 \_\_\_\_\_22679c55bd]  
 11 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_  
 \_remote\_contextua\_\_endpoints\_\_\_\_\_a1decdf0c, output/interaction/EnsambleMABInt  
 eraction/results/EnsambleMABInteraction\_\_\_remote\_contextua\_\_endpoints\_\_\_\_\_09d  
 6eb1a5c, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteractio  
 n\_\_\_remote\_contextua\_\_endpoints\_\_\_\_\_b4089aa1b7, output/interaction/EnsambleMA  
 BInteraction/results/EnsambleMABInteraction\_\_\_remote\_contextua\_\_endpoints\_\_\_\_\_  
 \_8483faf101, output/interaction/EnsambleMABInteraction/results/EnsambleMABIntera  
 ction\_\_\_remote\_contextua\_\_endpoints\_\_\_\_\_83cc906d2c, output/interaction/Ensambl  
 eMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_contextua\_\_endpoints\_  
 \_\_\_\_\_d4d6c15e56]  
 12 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_  
 \_remote\_epsilon\_g\_\_endpoints\_\_\_\_\_c76ad64378, output/interaction/EnsambleMABInt  
 eraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_endpoints\_\_\_\_\_faf  
 bba24ad, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteractio  
 n\_\_\_remote\_epsilon\_g\_\_endpoints\_\_\_\_\_bb7ec2218b, output/interaction/EnsambleMA  
 BInteraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_endpoints\_\_\_\_\_  
 \_92c596a4c7, output/interaction/EnsambleMABInteraction/results/EnsambleMABIntera

ction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_13e254b692, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_dd91393907, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_b42d6ffd47]  
 13 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_436fbee58a]  
 14 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_e2ed09fcb3, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_095d7a2bfa, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_26a98659b3, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_2997aaab26, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_f21e3b0cdb, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_34ddf7971c, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_da2ecff9fd]  
 15 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_146c3c13b4, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_4e361155b0, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_7ea703bb9b, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_463311502b, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_992dfd5c53, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_29f8333350, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_epsilon\_g\_\_\_endpoints\_\_\_\_\_e629c0a750]  
 16 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_uch\_\_\_endpoints\_\_\_\_\_432b72a2ba, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_uch\_\_\_endpoints\_\_\_\_\_ad84e1b2a4, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_uch\_\_\_endpoints\_\_\_\_\_b3ca04a155]  
 17 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_uch\_\_\_endpoints\_\_\_\_\_78b0b601e8]  
 18 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_uch\_\_\_endpoints\_\_\_\_\_ed5909cbac, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_uch\_\_\_endpoints\_\_\_\_\_7e7848f84c]  
 19 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_uch\_\_\_endpoints\_\_\_\_\_c6ad4386c3]  
 20 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_uch\_\_\_endpoints\_\_\_\_\_62a6f67423, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_uch\_\_\_endpoints\_\_\_\_\_c96b9331ac, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_uch\_\_\_endpoints\_\_\_\_\_09f70e856b]  
 21 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction\_\_\_remote\_uch\_\_\_endpoints\_\_\_\_\_5559c61cfe]

```
[11]: #df_params
```

### 1.1.1 Group Results per Bandit

```
[12]: list_bandits.head(2)
```

```
[12]: bandit_policy observation \
0 remote nanCDAE
1 remote nanCVAE

interaction \
0 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote__endpoints_____68e9460cc6]
1 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote__endpoints_____d73aad920]

name \
0 remotenanCDAE
1 remotenanCVAE

model \
0 output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____r
emote__endpoints_____68e9460cc6
1 output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____r
emote__endpoints_____d73aad920

model_list
0 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote__endpoints_____68e9460cc6]
1 [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction____
remote__endpoints_____d73aad920]
```

```
[13]: reward_metrics = []

for i, row in list_bandits.iterrows():
    try:
        df_metrics = get_metrics_reward(row['interaction'])

        df_metrics['bandit'] = str(row['bandit_policy']) + " " +
→str(row['observation'])
        df_metrics['model'] = row['model']

        df_g_metrics = group_metrics(df_metrics)
        reward_metrics.append(df_g_metrics)
    except FileNotFoundError:
        pass
```

```
[14]: df_all = pd.concat(reward_metrics)
df_all = df_all.reset_index().sort_values('bandit', ascending=False).
↳set_index('bandit')
df_all
```

```
[14]:
```

	r_mean mean \
bandit	
remote_ucb nan[MAB]UCB-5-10000	0.121764
remote_ucb nan[MAB]UCB-5	0.116273
remote_ucb nan[MAB]UCB-10-10000	0.126558
remote_ucb nan[MAB]UCB-10	0.113222
remote_ucb nan[MAB]UCB-1-10000	0.118801
remote_ucb nan[MAB]UCB-1	0.113571
remote_epsilon_greedy 0.2[MAB]e-greedy-0.2	0.108379
remote_epsilon_greedy 0.1[MAB]e-greedy-0.1	0.108167
remote_epsilon_greedy 0.05teste	0.106249
remote_epsilon_greedy 0.05[MAB]e-greedy-0.05	0.106735
remote_contextual_softmax nan[Contextual]Softmax-500	0.164865
remote_contextual_softmax nan[Contextual]Softmax-50	0.144266
remote_contextual_softmax nan[Contextual]Softmax-100	0.160173
remote_contextual_softmax nan[Contextual]Softmax-10	0.106710
remote_contextual_epsilon_greedy 0.2[CONTEXTUAL]e-greedy-0.05	0.151673
remote_contextual_epsilon_greedy 0.1[CONTEXTUAL]e-greedy-0.05	0.155159
remote_contextual_epsilon_greedy 0.05[CONTEXTUAL]e-greedy-0.05	0.147116
remote nanRandom	0.027456
remote nanMostPopular	0.091432
remote nanMatrixFactorization	0.105552
remote nanCVAE	0.110869
remote nanCDAE	0.094047

	r_mean std \
bandit	
remote_ucb nan[MAB]UCB-5-10000	NaN
remote_ucb nan[MAB]UCB-5	0.000000
remote_ucb nan[MAB]UCB-10-10000	NaN
remote_ucb nan[MAB]UCB-10	0.000000
remote_ucb nan[MAB]UCB-1-10000	NaN
remote_ucb nan[MAB]UCB-1	0.000000
remote_epsilon_greedy 0.2[MAB]e-greedy-0.2	0.002816
remote_epsilon_greedy 0.1[MAB]e-greedy-0.1	0.002719
remote_epsilon_greedy 0.05teste	NaN
remote_epsilon_greedy 0.05[MAB]e-greedy-0.05	0.005866
remote_contextual_softmax nan[Contextual]Softmax-500	0.002014
remote_contextual_softmax nan[Contextual]Softmax-50	0.000503
remote_contextual_softmax nan[Contextual]Softmax-100	0.001479
remote_contextual_softmax nan[Contextual]Softmax-10	0.000130
remote_contextual_epsilon_greedy 0.2[CONTEXTUAL]e-greedy-0.05	0.003052



remote_contextual_epsilon_greedy 0.1[CONTEXTUAL]e-greedy-0.05	0.003976
remote_contextual_epsilon_greedy 0.05[CONTEXTUAL]e-greedy-0.05	0.020916
remote nanRandom	NaN
remote nanMostPopular	NaN
remote nanMatrixFactorization	NaN
remote nanCVAE	NaN
remote nanCDAE	NaN

	r_reward mean \
bandit	
remote_ucb nan[MAB]UCB-5-10000	1397.000000
remote_ucb nan[MAB]UCB-5	1334.000000
remote_ucb nan[MAB]UCB-10-10000	1452.000000
remote_ucb nan[MAB]UCB-10	1299.000000
remote_ucb nan[MAB]UCB-1-10000	1363.000000
remote_ucb nan[MAB]UCB-1	1303.000000
remote_epsilon_greedy 0.2[MAB]e-greedy-0.2	1243.428571
remote_epsilon_greedy 0.1[MAB]e-greedy-0.1	1241.000000
remote_epsilon_greedy 0.05teste	1219.000000
remote_epsilon_greedy 0.05[MAB]e-greedy-0.05	1224.571429
remote_contextual_softmax nan[Contextual]Softmax-500	1891.500000
remote_contextual_softmax nan[Contextual]Softmax-50	1655.166667
remote_contextual_softmax nan[Contextual]Softmax-100	1837.666667
remote_contextual_softmax nan[Contextual]Softmax-10	1224.285714
remote_contextual_epsilon_greedy 0.2[CONTEXTUAL]e-greedy-0.05	1740.142857
remote_contextual_epsilon_greedy 0.1[CONTEXTUAL]e-greedy-0.05	1780.142857
remote_contextual_epsilon_greedy 0.05[CONTEXTUAL]e-greedy-0.05	1687.857143
remote nanRandom	315.000000
remote nanMostPopular	1049.000000
remote nanMatrixFactorization	1211.000000
remote nanCVAE	1272.000000
remote nanCDAE	1079.000000

	r_reward std \
bandit	
remote_ucb nan[MAB]UCB-5-10000	NaN
remote_ucb nan[MAB]UCB-5	0.000000
remote_ucb nan[MAB]UCB-10-10000	NaN
remote_ucb nan[MAB]UCB-10	0.000000
remote_ucb nan[MAB]UCB-1-10000	NaN
remote_ucb nan[MAB]UCB-1	0.000000
remote_epsilon_greedy 0.2[MAB]e-greedy-0.2	32.310252
remote_epsilon_greedy 0.1[MAB]e-greedy-0.1	31.192948
remote_epsilon_greedy 0.05teste	NaN
remote_epsilon_greedy 0.05[MAB]e-greedy-0.05	67.302445
remote_contextual_softmax nan[Contextual]Softmax-500	23.106276
remote_contextual_softmax nan[Contextual]Softmax-50	5.776389

remote_contextual_softmax nan[Contextual]Softmax-100	16.966634
remote_contextual_softmax nan[Contextual]Softmax-10	1.496026
remote_contextual_epsilon_greedy 0.2[CONTEXTUAL]e-greedy-0.05	35.011563
remote_contextual_epsilon_greedy 0.1[CONTEXTUAL]e-greedy-0.05	45.612237
remote_contextual_epsilon_greedy 0.05[CONTEXTUAL]e-greedy-0.05	239.971824
remote nanRandom	NaN
remote nanMostPopular	NaN
remote nanMatrixFactorization	NaN
remote nanCVAE	NaN
remote nanCDAE	NaN

	r_reward count
\	
bandit	
remote_ucb nan[MAB]UCB-5-10000	1
remote_ucb nan[MAB]UCB-5	3
remote_ucb nan[MAB]UCB-10-10000	1
remote_ucb nan[MAB]UCB-10	2
remote_ucb nan[MAB]UCB-1-10000	1
remote_ucb nan[MAB]UCB-1	3
remote_epsilon_greedy 0.2[MAB]e-greedy-0.2	7
remote_epsilon_greedy 0.1[MAB]e-greedy-0.1	7
remote_epsilon_greedy 0.05teste	1
remote_epsilon_greedy 0.05[MAB]e-greedy-0.05	7
remote_contextual_softmax nan[Contextual]Softmax-500	6
remote_contextual_softmax nan[Contextual]Softmax-50	6
remote_contextual_softmax nan[Contextual]Softmax-100	6
remote_contextual_softmax nan[Contextual]Softmax-10	7
remote_contextual_epsilon_greedy 0.2[CONTEXTUAL]e-greedy-0.05	7
remote_contextual_epsilon_greedy 0.1[CONTEXTUAL]e-greedy-0.05	7
remote_contextual_epsilon_greedy 0.05[CONTEXTUAL]e-greedy-0.05	7
remote nanRandom	1
remote nanMostPopular	1
remote nanMatrixFactorization	1
remote nanCVAE	1
remote nanCDAE	1

model first	
bandit	
remote_ucb nan[MAB]UCB-5-10000	output/interacti
on/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_ucb___endpoin	
ts_____5559c61cfe	
remote_ucb nan[MAB]UCB-5	output/interacti
on/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_ucb___endpoin	
ts_____c96b9331ac	
remote_ucb nan[MAB]UCB-10-10000	output/interacti
on/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_ucb___endpoin	

```

ts_____c6ad4386c3
remote_ucb nan[MAB]UCB-10 output/interacti
on/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_ucb___endpoin
ts_____7e7848f84c
remote_ucb nan[MAB]UCB-1-10000 output/interacti
on/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_ucb___endpoin
ts_____78b0b601e8
remote_ucb nan[MAB]UCB-1 output/interacti
on/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_ucb___endpoin
ts_____ad84e1b2a4
remote_epsilon_greedy 0.2[MAB]e-greedy-0.2 output/interacti
on/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_epsilon_g___e
ndpoints_____e629c0a750
remote_epsilon_greedy 0.1[MAB]e-greedy-0.1 output/interacti
on/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_epsilon_g___e
ndpoints_____f21e3b0cdb
remote_epsilon_greedy 0.05teste output/interacti
on/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_epsilon_g___e
ndpoints_____436fbee58a
remote_epsilon_greedy 0.05[MAB]e-greedy-0.05 output/interacti
on/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_epsilon_g___e
ndpoints_____fafbba24ad
remote_contextual_softmax nan[Contextual]Softmax-500 output/interacti
on/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___e
ndpoints_____83cc906d2c
remote_contextual_softmax nan[Contextual]Softmax-50 output/interacti
on/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___e
ndpoints_____ffe1f228b7
remote_contextual_softmax nan[Contextual]Softmax-100 output/interacti
on/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___e
ndpoints_____40ea7b2e43
remote_contextual_softmax nan[Contextual]Softmax-10 output/interacti
on/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___e
ndpoints_____d17a43231d
remote_contextual_epsilon_greedy 0.2[CONTEXTUAL]e-greedy-0.05 output/interacti
on/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___e
ndpoints_____433956de17
remote_contextual_epsilon_greedy 0.1[CONTEXTUAL]e-greedy-0.05 output/interacti
on/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___e
ndpoints_____5091adba5a
remote_contextual_epsilon_greedy 0.05[CONTEXTUAL]e-greedy-0.05 output/interacti
on/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___e
ndpoints_____675b43b6a5
remote nanRandom output/interacti
on/EnsambleMABInteraction/results/EnsambleMABInteraction___remote___endpoints__
____44e07863e7
remote nanMostPopular output/interacti

```

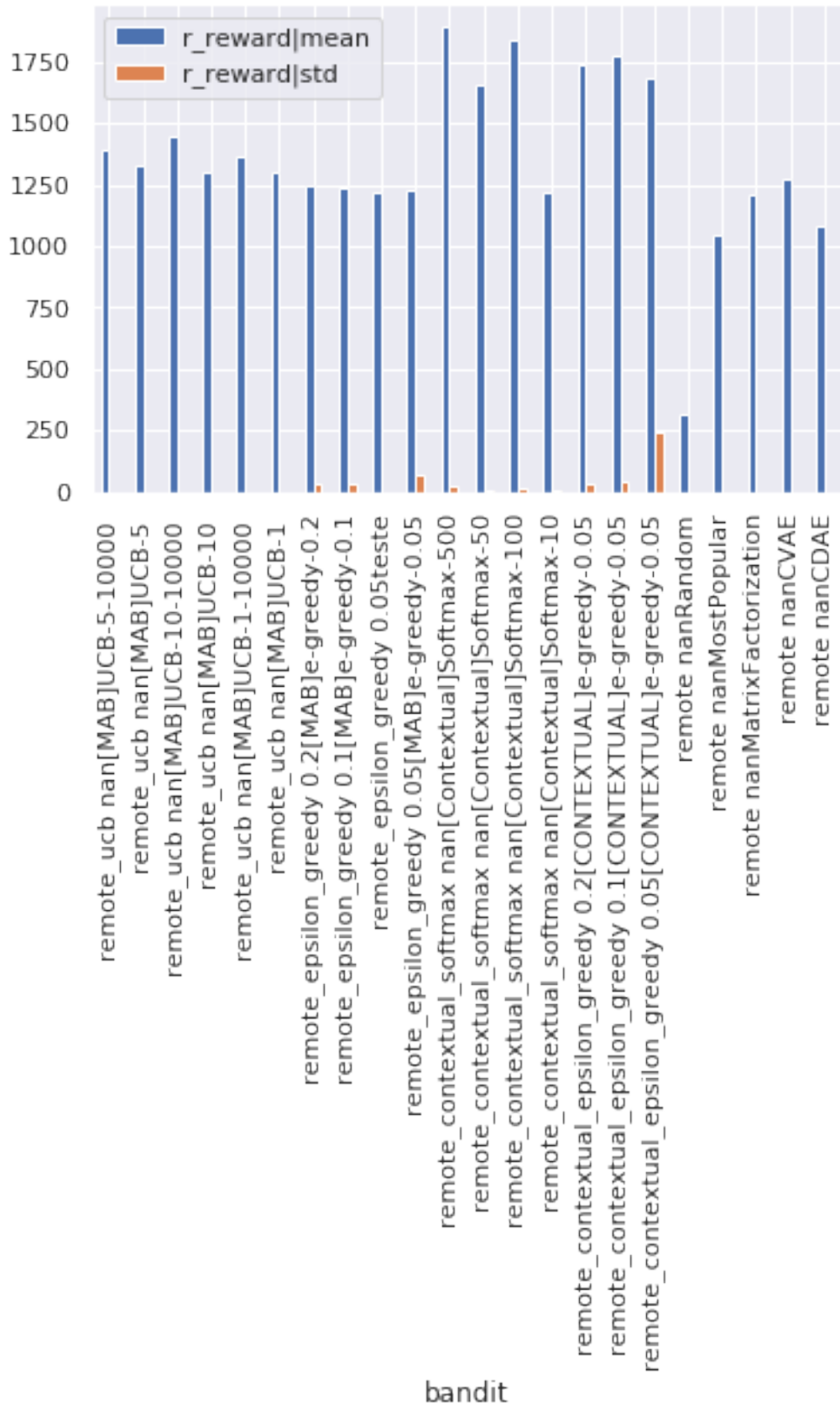
```

on/EnsambleMABInteraction/results/EnsambleMABInteraction___remote___endpoints__
___5dab9c3b0a
remote nanMatrixFactorization                                output/interacti
on/EnsambleMABInteraction/results/EnsambleMABInteraction___remote___endpoints__
___d2667d3c0b
remote nanCVAE                                                output/interacti
on/EnsambleMABInteraction/results/EnsambleMABInteraction___remote___endpoints__
___d73aad920
remote nanCDAE                                                output/interacti
on/EnsambleMABInteraction/results/EnsambleMABInteraction___remote___endpoints__
___68e9460cc6

```

```
[15]: df_all[['r_reward|mean', 'r_reward|std']].plot(kind='bar')
```

```
[15]: <matplotlib.axes._subplots.AxesSubplot at 0x7f56aa99cb00>
```



```
[16]: #c = ['remote_ucb nan[MAB]UCB-1-10000      ', 'remote_ucb_
      ↪nan[MAB]UCB-5-10000      ', 'remote_ucb nan[MAB]UCB-10-10000      ']
      #df_all.loc[c].round(3)
```

```
[17]: df_all.to_csv("output/tmp/stats.csv", float_format='%.3f')
```

## 1.2 Plot Results

```
[18]: df_models = list_bandits.set_index('name')[['model_list']]
      df_models.index
```

```
[18]: Index(['remotenanCDAE', 'remotenanCVAE', 'remotenanMatrixFactorization',
            'remotenanMostPopular', 'remotenanRandom',
            'remote_contextual_epsilon_greedy0.05[CONTEXTUAL]e-greedy-0.05',
            'remote_contextual_epsilon_greedy0.1[CONTEXTUAL]e-greedy-0.05',
            'remote_contextual_epsilon_greedy0.2[CONTEXTUAL]e-greedy-0.05',
            'remote_contextual_softmaxnan[Contextual]Softmax-10',
            'remote_contextual_softmaxnan[Contextual]Softmax-100',
            'remote_contextual_softmaxnan[Contextual]Softmax-50',
            'remote_contextual_softmaxnan[Contextual]Softmax-500',
            'remote_epsilon_greedy0.05[MAB]e-greedy-0.05',
            'remote_epsilon_greedy0.05teste',
            'remote_epsilon_greedy0.1[MAB]e-greedy-0.1',
            'remote_epsilon_greedy0.2[MAB]e-greedy-0.2', 'remote_ucbnan[MAB]UCB-1',
            'remote_ucbnan[MAB]UCB-1-10000', 'remote_ucbnan[MAB]UCB-10',
            'remote_ucbnan[MAB]UCB-10-10000', 'remote_ucbnan[MAB]UCB-5',
            'remote_ucbnan[MAB]UCB-5-10000'],
            dtype='object', name='name')
```

```
[19]: legend = {'remotenanCDAE': "CDAE",
               'remotenanCVAE': "CVAE",
               'remotenanMatrixFactorization': 'Matrix Factorization',
               'remotenanMostPopular': 'Most Popular',
               'remotenanMostPopularPerUser': 'Most Popular per User',
               'remotenanRandom': 'Random',
               'remote_contextual_epsilon_greedy[Contextual]e-greedy': 'Contextual_
      ↪e-greedy',
               'remote_contextual_softmax[Contextual]Softmax': 'Contextual Softmax',
               'remote_epsilon_greedy[MAB]e-greedy': 'e-greedy',
               'remote_ucb[MAB]UCB': 'UCB',
               'remote_contextual_softmaxnan[Contextual]Softmax-10': 'Meta-Bandit_
      ↪Softmax (10)',
               'remote_contextual_softmaxnan[Contextual]Softmax-50': 'Meta-Bandit_
      ↪Softmax (50)',
```

```

        'remote_contextual_softmaxnan[Contextual]Softmax-100': 'Meta-Bandit_
↳Softmax (100)',
        'remote_contextual_softmaxnan[Contextual]Softmax-500': 'Meta-Bandit_
↳Softmax (500)',
        'remote_contextual_epsilon_greedy0.05[CONTEXTUAL]e-greedy-0.05':_
↳'Meta-Bandit e-greedy (0.05)',
        'remote_contextual_epsilon_greedy0.1[CONTEXTUAL]e-greedy-0.05':_
↳'Meta-Bandit e-greedy (0.1)',
        'remote_contextual_epsilon_greedy0.2[CONTEXTUAL]e-greedy-0.05':_
↳'Meta-Bandit e-greedy (0.2)',
        'remote_ucbnnan[MAB]UCB-1-10000': "Meta-Bandit UCB (1)",
        'remote_ucbnnan[MAB]UCB-10-10000': "Meta-Bandit UCB (10)",
        'remote_ucbnnan[MAB]UCB-5-10000': "Meta-Bandit UCB (5)",
    }

df_models.index = df_models.index.map(legend)
#df_models['model'] = df_models['bandit']
df_models.head(10)

```

```

[19]: model_list
name
CDAE [output/interaction/EnsambleMABInteraction/results/
EnsambleMABInteraction___remote___endpoints_____68e9460cc6]
CVAE [output/interaction/EnsambleMABInteraction/results/
EnsambleMABInteraction___remote___endpoints_____d73aad920]
Matrix Factorization [output/interaction/EnsambleMABInteraction/results/
EnsambleMABInteraction___remote___endpoints_____d2667d3c0b]
Most Popular [output/interaction/EnsambleMABInteraction/results/
EnsambleMABInteraction___remote___endpoints_____5dab9c3b0a]
Random [output/interaction/EnsambleMABInteraction/results/
EnsambleMABInteraction___remote___endpoints_____44e07863e7]
Meta-Bandit e-greedy (0.05) [output/interaction/EnsambleMABInteraction/results/
EnsambleMABInteraction___remote_contextua___endpoints_____09ec6475d3, output/i
nteraction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_conte
xtua___endpoints_____6d792a3ed1, output/interaction/EnsambleMABInteraction/resu
lts/EnsambleMABInteraction___remote_contextua___endpoints_____afb131bbc0, outp
ut/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_c
ontextua___endpoints_____675b43b6a5, output/interaction/EnsambleMABInteraction/
results/EnsambleMABInteraction___remote_contextua___endpoints_____2c656f2636,
output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remo
te_contextua___endpoints_____4184b0299f, output/interaction/EnsambleMABInteract
ion/results/EnsambleMABInteraction___remote_contextua___endpoints_____a0d520e8
92]
Meta-Bandit e-greedy (0.1) [output/interaction/EnsambleMABInteraction/results/
EnsambleMABInteraction___remote_contextua___endpoints_____5091adba5a, output/i
nteraction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_conte
xtua___endpoints_____d08250e913, output/interaction/EnsambleMABInteraction/resu

```

```
lts/EnsambleMABInteraction___remote_contextua___endpoints_____5c5906d549, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____8a7bb007f0, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____3ccb54e1a4, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____03a780dcaf, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____e0b5f34e99]
```

```
Meta-Bandit e-greedy (0.2) [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____6e9c4bdd6a, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____5fc531976b, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____7ac2a172ad, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____43a64bfd00, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____f685f4e615, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____5afaccebb8, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____433956de17]
```

```
Meta-Bandit Softmax (10) [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____3615524b61, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____0741e343b3, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____1b016623d3, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____924996f8b7, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____c6345e61c1, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____64a11b890d, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____d17a43231d]
```

```
Meta-Bandit Softmax (100) [output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____fdcd2bc277, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____4f2a116ad0, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____40ea7b2e43, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____56033066b8, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____f8ceb8586d, output/interaction/EnsambleMABInteraction/results/EnsambleMABInteraction___remote_contextua___endpoints_____8842e01077]
```

[ ]:

[20]: bandits = legend.values()



```
sample_size      = 15000
window_size      = 1000
bandits
```

```
[20]: dict_values(['CDAE', 'CVAE', 'Matrix Factorization', 'Most Popular', 'Most Popular per User', 'Random', 'Contextual e-greedy', 'Contextual Softmax', 'e-greedy', 'UCB', 'Meta-Bandit Softmax (10)', 'Meta-Bandit Softmax (50)', 'Meta-Bandit Softmax (100)', 'Meta-Bandit Softmax (500)', 'Meta-Bandit e-greedy (0.05)', 'Meta-Bandit e-greedy (0.1)', 'Meta-Bandit e-greedy (0.2)', 'Meta-Bandit UCB (1)', 'Meta-Bandit UCB (10)', 'Meta-Bandit UCB (5)'])
```

```
[21]: # df_metrics      = load_all_interaction_metrics(input_interaction, sample_size)

# df_metrics.groupby(['interaction', 'idx']).sum().fillna(0).groupby(level=0).
↳rolling(window = window_size, min_periods=1).mean().reset_index(drop=True)
```

```
[22]: def load_dataset(df_models, bandits, sample_size):
    data = []
    for bandit in bandits:
        input_interaction = [p.split("/")[1] for p in df_models.loc[bandit].
↳model_list]
        df_metrics      = load_all_interaction_metrics(input_interaction,
↳sample_size)
        #params          = load_interactions_params2(input_interaction)

        df              = load_all_interaction_metrics(input_interaction, sample_size)
        df['_idx'] = 1
        df_metrics      = df.groupby(['interaction', 'idx']).sum().
↳fillna(0).groupby(level=0).cumsum().reset_index()
        df_metrics['mean_reward'] = (df_metrics.reward/df_metrics._idx).
↳fillna(0)
        df_metrics['mean_reward_win'] = df.groupby(['interaction', 'idx']).sum().
↳fillna(0).groupby(level=0).rolling(window = window_size, min_periods=1).
↳mean().reset_index(drop=True).reward

        df_metrics['bandit']      = bandit
        df_metrics['Model']      = bandit

        data.append(df_metrics)
    return pd.concat(data, ignore_index=True)
#
#
#df_group = load_dataset(df_models, bandits, sample_size)
#df_group.tail()
```

```
[23]: #df_group['idx'].isin(df_group.idx.sample(200, random_state=41))
```

[ ]:

### 1.2.1 Cumulative Reward

```
[24]: def plot_cum_reward(df, column='mean_reward', hue='bandit', legend=False,
    ↪ legend_extern=False,
    ylim=1, hue_order=None, y_axes=True, markersize=6):
    name = models[0].replace(" ", "_")
    #df = df[df.idx > 10]
    steps = int(df_group.idx.max()/25)
    idx = [steps*i for i in range(steps)]
    df = df[df.idx.isin(idx)]
    #df = df.sample(200, random_state=41)

    plt.figure()
    sns.set(style="darkgrid")
    sns.set(style="whitegrid", rc={"lines.scale_dashes": True, "lines.
    ↪ linewidth": 2.0})

    # Plot the responses for different events and regions
    ax = sns.lineplot(x="idx", y=column, markers=markers, dashes=False,
    ↪ palette=palette,
    style=hue, hue=hue, hue_order=hue_order, legend=legend,
    ↪ data=df, markersize=markersize)
    ax.set_ylim(0,ylim)
    ax.set_yticks([0,500,1000,1500,2000])

    #ax.set(xlabel='Interactions', ylabel='Cumulative Mean Reward',fontsize=20)
    ax.tick_params(labelsize=11)
    ax.set_xlabel('Interactions',fontsize=15);
    if y_axes:
        ax.set_ylabel('Cumulative Reward',fontsize=15);
    else:
        ax.set_ylabel("")
    # Put the legend out of the figure
    if legend and legend_extern:
        plt.legend(bbox_to_anchor=(1.05, 1), loc=2, borderaxespad=0.
    ↪ ,fontsize=12)

    ax.grid(False)

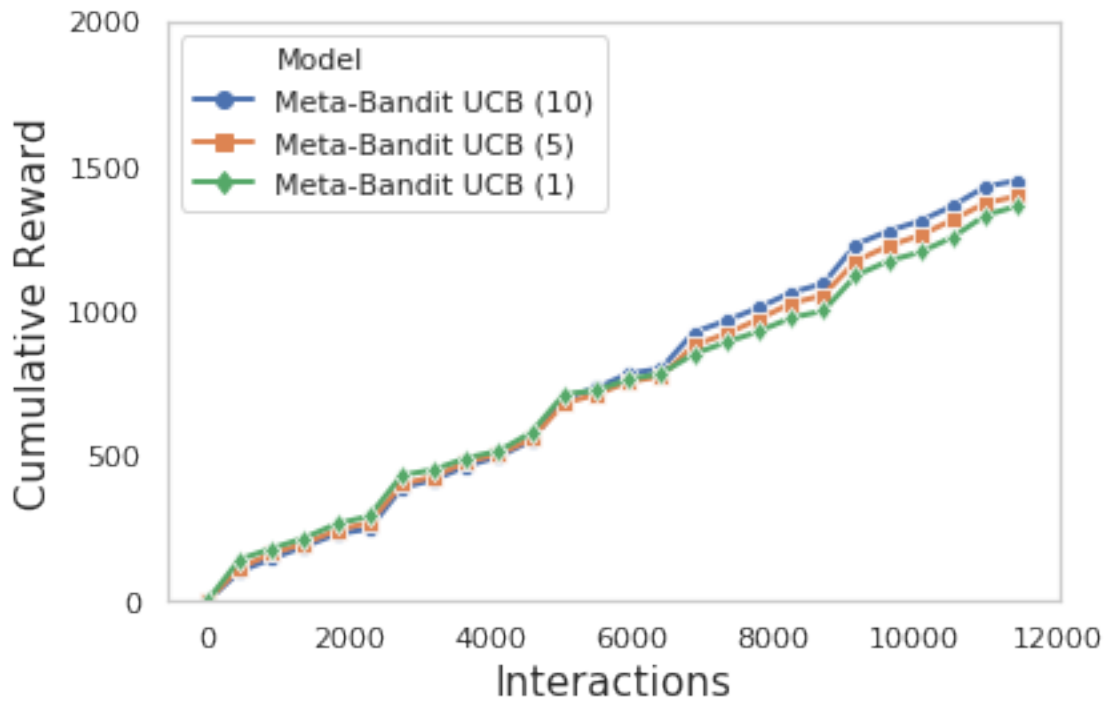
    plt.savefig("output/tmp/plot_cum_reward_{}_{}_{}.pdf".
    ↪ format(name,legend,legend_extern) ,dpi=300, bbox_inches="tight")
    plt.show()
```

Cumulate Reward hyperparams

```
[ ]:
```

```
[25]: models = ["Meta-Bandit UCB (10)", "Meta-Bandit UCB (5)", "Meta-Bandit UCB (1)"]
palette = dict(zip(models, sns.color_palette("deep", 7)))
markers = dict(zip(models, ["o", "s", "d", "P", "X", "^", "v"]))

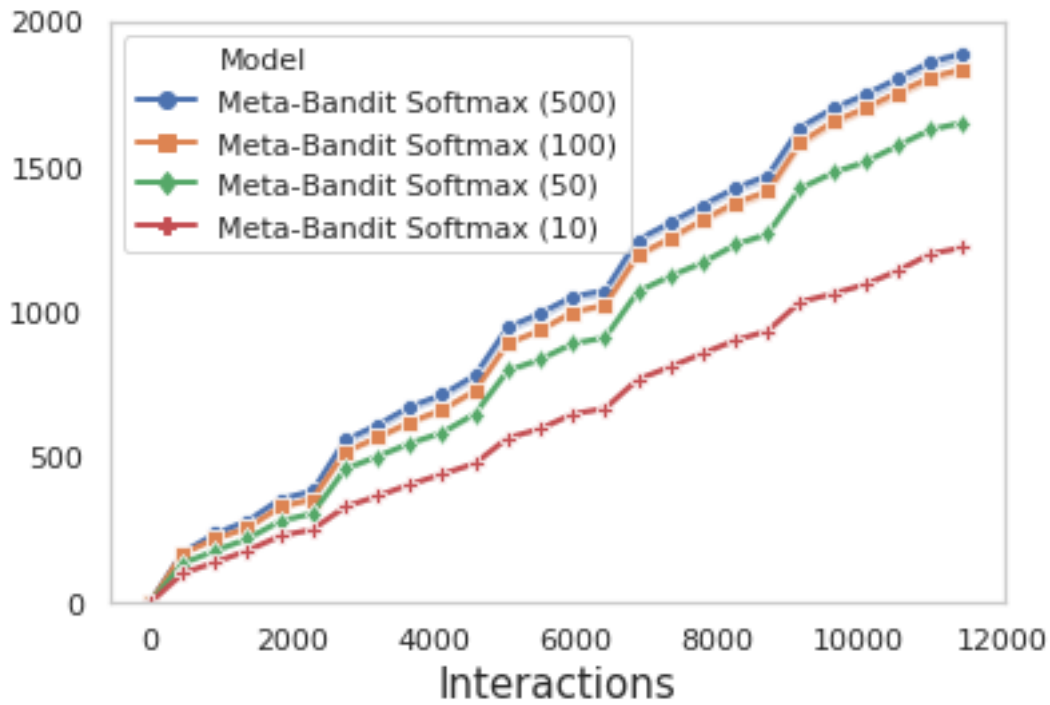
df_group = load_dataset(df_models, models, sample_size)
plot_cum_reward(df_group, column='reward', legend='full', hue='Model',
→hue_order=models, ylim=2000, y_axes=True)
```



```
[26]: models = ['Meta-Bandit Softmax (500)', 'Meta-Bandit Softmax (100)',
                'Meta-Bandit Softmax (50)', 'Meta-Bandit Softmax (10)']
palette = dict(zip(models, sns.color_palette("deep", 7)))
markers = dict(zip(models, ["o", "s", "d", "P", "X", "^", "v"]))
```

```
[27]: df_group = load_dataset(df_models, models, sample_size)
#df_group = df_group.groupby(['Model', 'idx']).median().reset_index()

plot_cum_reward(df_group, column='reward', legend='full', hue='Model',
→hue_order=models, ylim=2000, y_axes=False)
```



```
[ ]:
```

```
[28]: models = ['Meta-Bandit e-greedy (0.1)', 'Meta-Bandit e-greedy (0.2)',  
↳ 'Meta-Bandit e-greedy (0.05)']
```

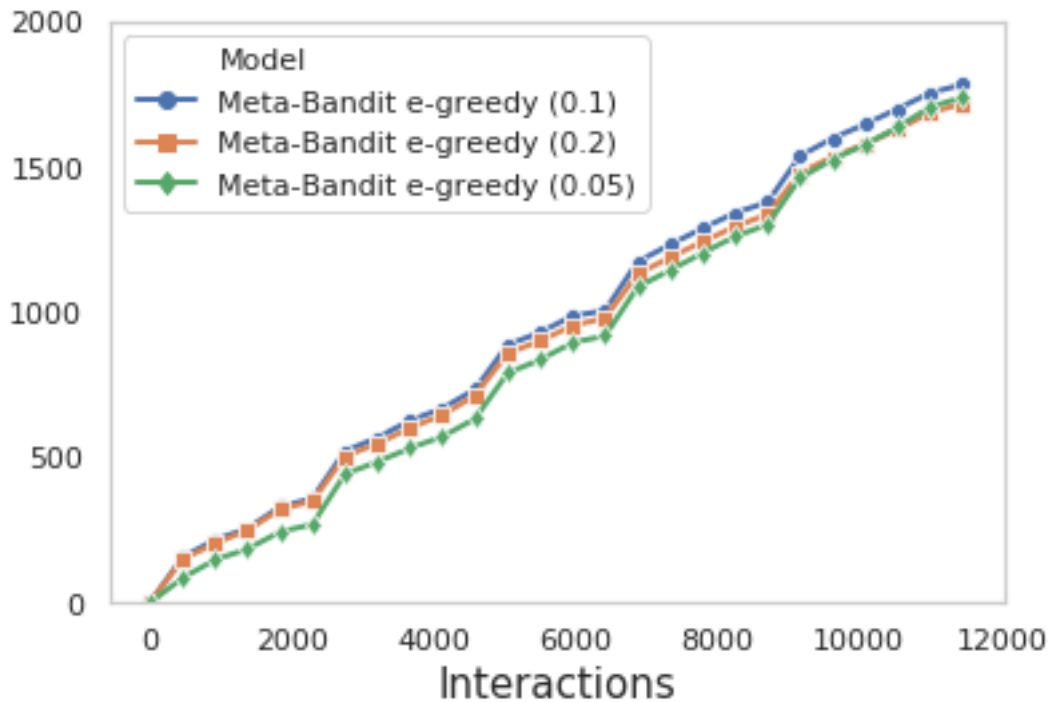
```
palette = dict(zip(models, sns.color_palette("deep", 7)))
```

```
markers = dict(zip(models, ["o", "s", "d", "p", "X", "^", "v"]))
```

```
[29]: df_group = load_dataset(df_models, models, sample_size)
```

```
df_group = df_group.groupby(['Model', 'idx']).median().reset_index()
```

```
plot_cum_reward(df_group, column='reward', legend='full', hue='Model',  
↳ hue_order=models, ylim=2000, y_axes=False)
```



```
[ ]:
```

### Cumulate Reward Best Models

```
[30]: legend.values()
```

```
[30]: dict_values(['CDAE', 'CVAE', 'Matrix Factorization', 'Most Popular', 'Most Popular per User', 'Random', 'Contextual e-greedy', 'Contextual Softmax', 'e-greedy', 'UCB', 'Meta-Bandit Softmax (10)', 'Meta-Bandit Softmax (50)', 'Meta-Bandit Softmax (100)', 'Meta-Bandit Softmax (500)', 'Meta-Bandit e-greedy (0.05)', 'Meta-Bandit e-greedy (0.1)', 'Meta-Bandit e-greedy (0.2)', 'Meta-Bandit UCB (1)', 'Meta-Bandit UCB (10)', 'Meta-Bandit UCB (5)'])
```

```
[31]: models = ['Meta-Bandit Softmax (500)',
               'Meta-Bandit UCB (10)', 'CVAE', 'CDAE',
               'Matrix Factorization', 'Most Popular', 'Random']
palette = dict(zip(models, sns.color_palette("deep", 8)))

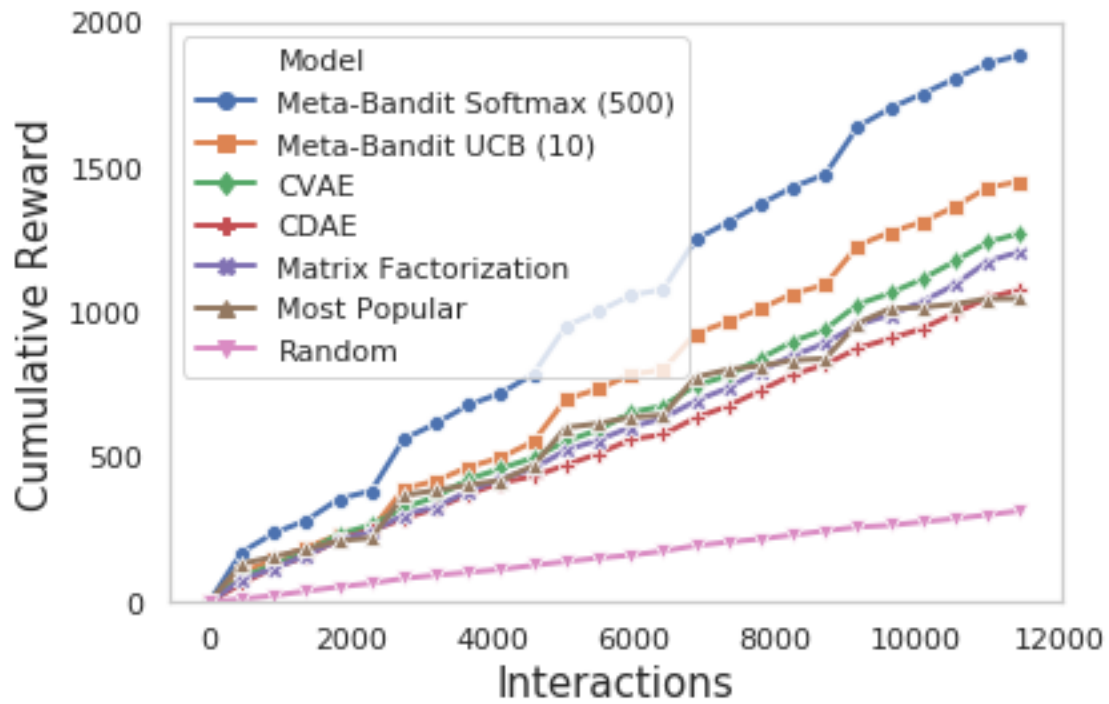
markers = dict(zip(models, ["o", "s", "d", "P", "X", "^", "v", "."]))
```

```
[32]: df_group = load_dataset(df_models, models, sample_size)
df_group = df_group.groupby(['Model', 'idx']).median().reset_index()

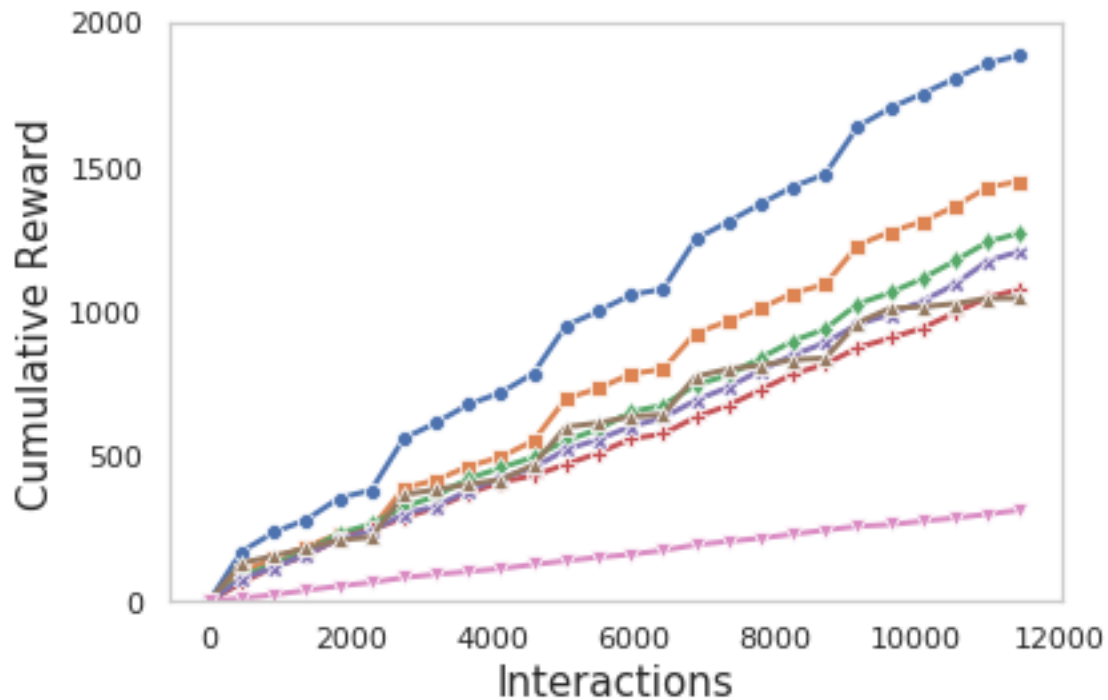
plt.figure(figsize=(100, 500))
```

```
plot_cum_reward(df_group, column='reward', legend='full', hue='Model',
               hue_order=models, ylim=2000)
```

<Figure size 7200x36000 with 0 Axes>



```
[33]: plot_cum_reward(df_group, column='reward', legend=False, hue='Model',
                    hue_order=models, ylim=2000, legend_extrn=False)
```



### 1.2.2 Cumulative Mean Reward

```
[34]: from matplotlib.colors import LogNorm
def plot_cum_mean_reward(df, column='mean_reward', hue='bandit', hue_order=None,
                        legend=False, legend_extrn=False, markersize=5,
                        ylim=1, title="plot_cum_mean_reward", palette=palette,
                        figsize=None):
    #df = df.sample(200, random_state=41)

    steps = int(df_group.idx.max()/35)
    idx = [steps*i for i in range(steps)]
    df = df[df.idx.isin(idx)]

    plt.figure(figsize=figsize)
    sns.set(style="whitegrid", rc={"lines.scale_dashes": True, "lines.
    linewidth": 2.0})

    # Plot the responses for different events and regions
    ax = sns.lineplot(x="idx", y=column, markers=markers, dashes=False,
    palette=palette,
                        style=hue, hue=hue, hue_order=hue_order, legend=legend,
    data=df, markersize=markersize)
    ax.set_ylim(0,ylim)
```

```

#ax.set(xlabel='Interactions', ylabel='Cumulative Mean Reward',fontSize=20)
ax.tick_params(labelsize=11)
ax.set_yticks([0,0.1,0.2,0.3,0.4])
ax.set_xlabel('Interactions',fontSize=15);
ax.set_ylabel('Cumulative Mean Reward',fontSize=15);
# Put the legend out of the figure
if legend and legend_extern:
    plt.legend(bbox_to_anchor=(1.05, 1), loc=2, borderaxespad=0.
→,fontSize=15)

ax.grid(False)

#ax.set_xticklabels(["1", "2", "3", "4", "5", "6", "7"])

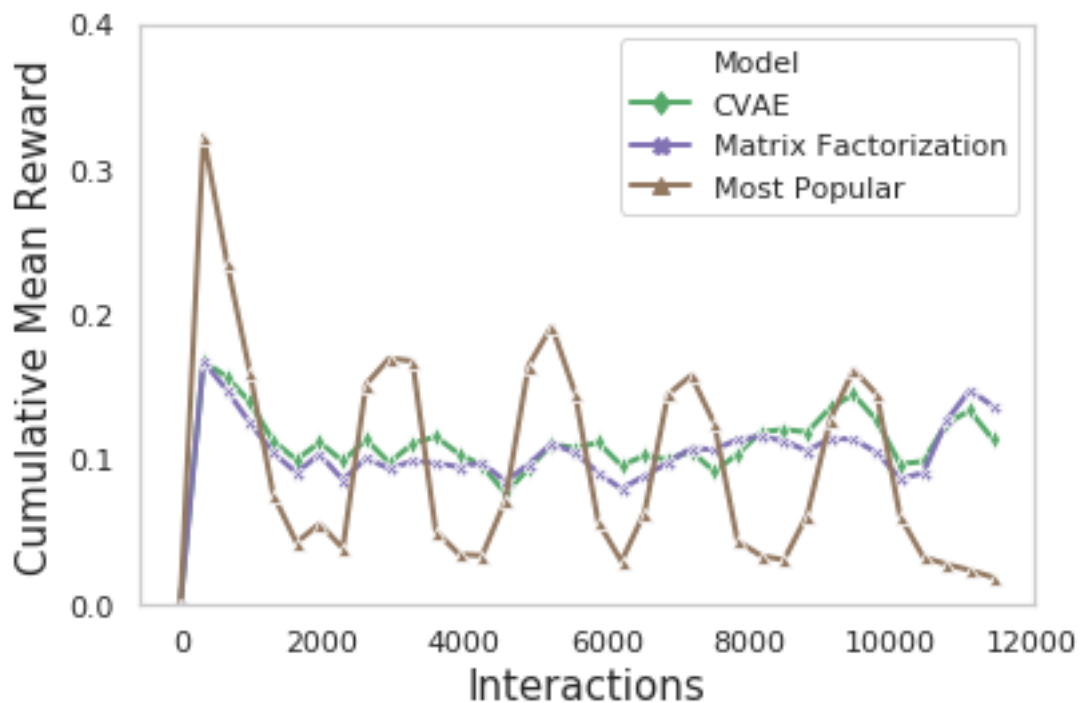
plt.savefig("output/tmp/{}_{}_{}.pdf".format(title, legend,
→legend_extern),dpi=300, bbox_inches="tight")
plt.show()

```

```

[35]: models = ['CVAE', 'Matrix Factorization', 'Most Popular']
df_group = load_dataset(df_models, models, sample_size)
df_group = df_group.groupby(['Model', 'idx']).mean().reset_index()
plot_cum_mean_reward(df_group, column='mean_reward_win',
→title="plot_cum_mean_reward_models",
                      legend='full',hue_order=models, hue='Model', ylim=0.4)

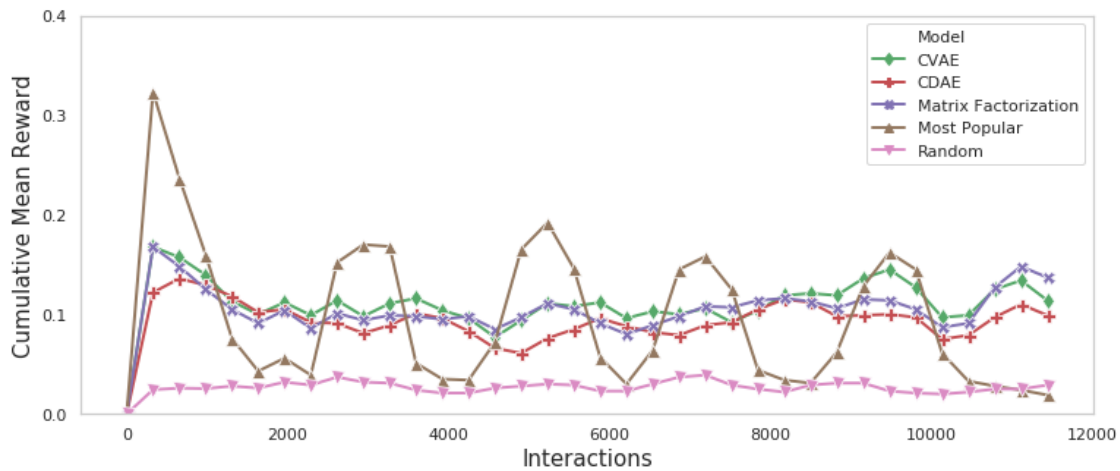
```



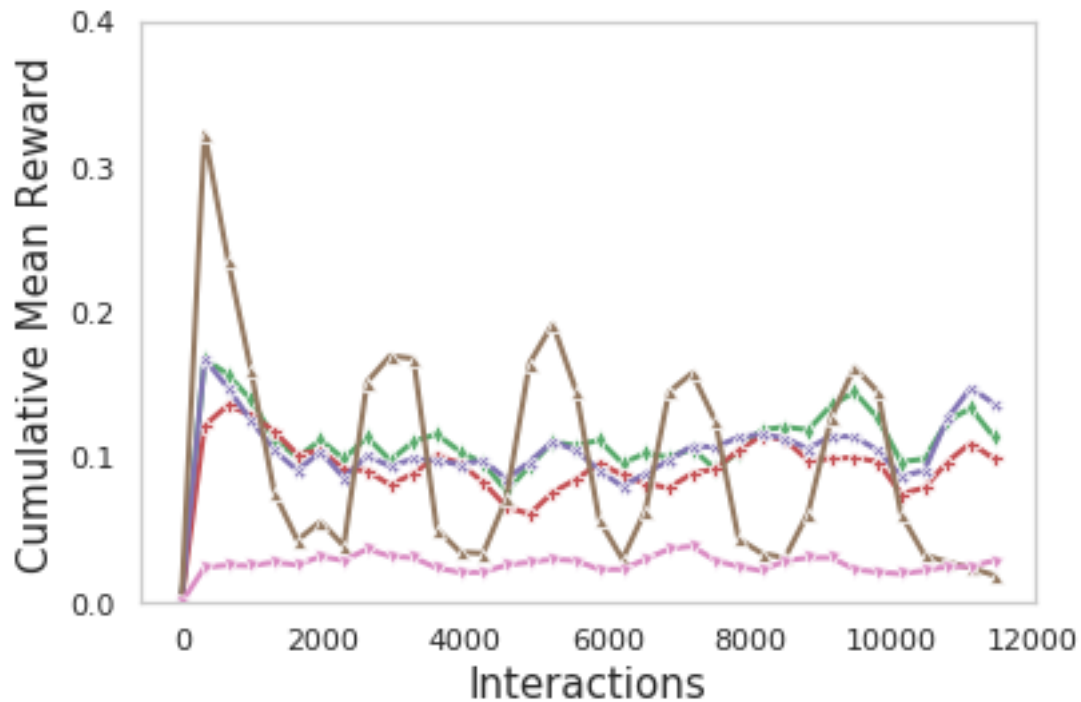


```
[36]: models = ['CVAE', 'CDAE', 'Matrix Factorization', 'Most Popular', 'Random']
df_group = load_dataset(df_models, models, sample_size)
df_group = df_group.groupby(['Model', 'idx']).mean().reset_index()

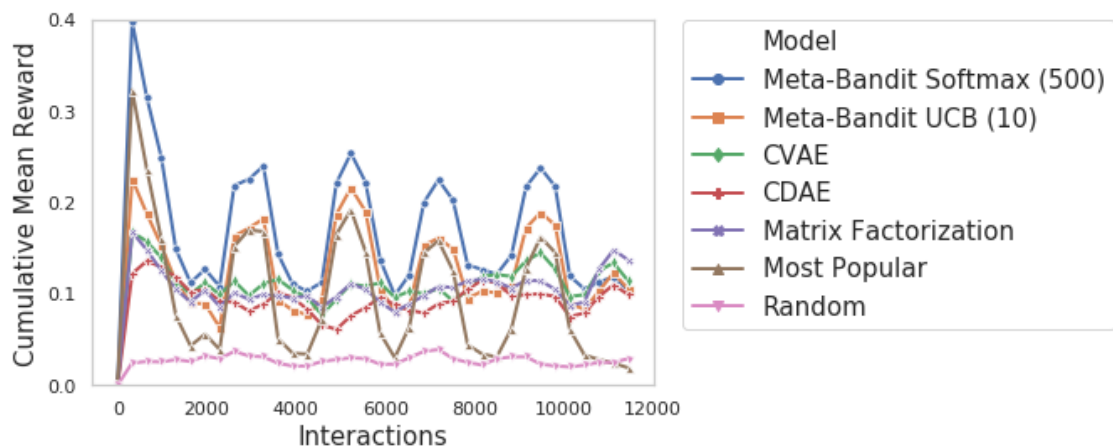
plot_cum_mean_reward(df_group, column='mean_reward_win',
    title="plot_cum_mean_reward_models", markersize=9,
    legend='full', hue_order=models, hue='Model', ylim=0.4,
    figsize=(12.4, 5))
```



```
[37]: models = ['CVAE', 'CDAE', 'Matrix Factorization', 'Most Popular', 'Random']
df_group = load_dataset(df_models, models, sample_size)
df_group = df_group.groupby(['Model', 'idx']).mean().reset_index()
plot_cum_mean_reward(df_group, column='mean_reward_win',
    title="plot_cum_mean_reward_models_note_legend",
    legend=False, hue_order=models, hue='Model', ylim=0.4)
```

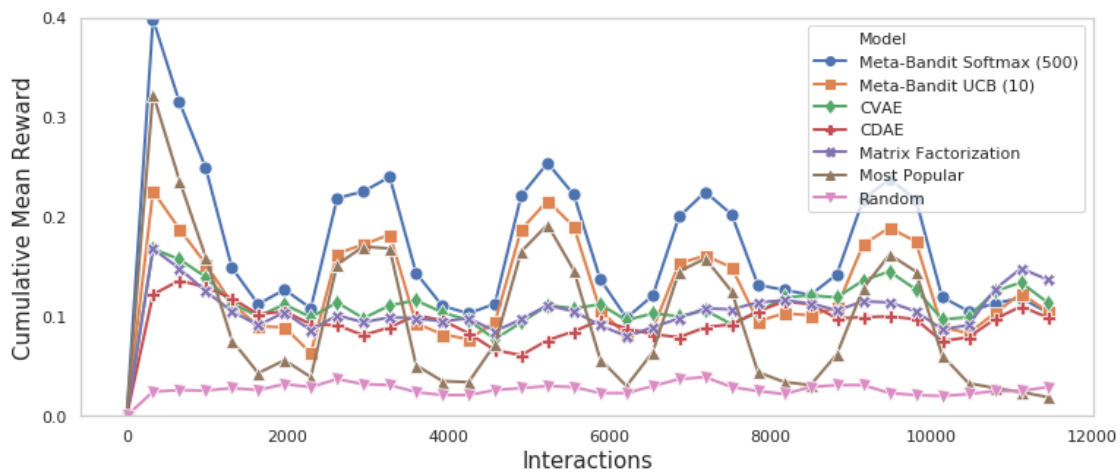


```
[38]: models = ['Meta-Bandit Softmax (500)',
                'Meta-Bandit UCB (10)',
                'CVAE', 'CDAE', 'Matrix Factorization', 'Most Popular', 'Random']
df_group = load_dataset(df_models, models, sample_size)
df_group = df_group.groupby(['Model', 'idx']).mean().reset_index()
plot_cum_mean_reward(df_group, column='mean_reward_win',
                    title="plot_cum_mean_reward_all_models_slim",
                    legend='full', hue_order=models, hue='Model', ylim=0.4,
                    legend_extern=True)
```



```
[39]: models = ['Meta-Bandit Softmax (500)',
               'Meta-Bandit UCB (10)',
               'CVAE', 'CDAE', 'Matrix Factorization', 'Most Popular', 'Random']
df_group = load_dataset(df_models, models, sample_size)
df_group = df_group.groupby(['Model', 'idx']).mean().reset_index()

plot_cum_mean_reward(df_group, column='mean_reward_win',
                    title="plot_cum_mean_reward_all_models", markersize=9,
                    legend='full', hue_order=models, hue='Model', ylim=0.4,
                    figsize=(12.4, 5))
```



```
[40]: sns.color_palette()
```

```
[40]: [(0.2980392156862745, 0.4470588235294118, 0.6901960784313725),
       (0.8666666666666667, 0.5176470588235295, 0.3215686274509804),
       (0.3333333333333333, 0.6588235294117647, 0.40784313725490196),
       (0.7686274509803922, 0.3058823529411765, 0.3215686274509804),
       (0.5058823529411764, 0.4470588235294118, 0.7019607843137254),
       (0.5764705882352941, 0.47058823529411764, 0.3764705882352941),
       (0.8549019607843137, 0.5450980392156862, 0.7647058823529411),
       (0.5490196078431373, 0.5490196078431373, 0.5490196078431373),
       (0.8, 0.7254901960784313, 0.4549019607843137),
       (0.39215686274509803, 0.7098039215686275, 0.803921568627451)]
```

```
[41]: palette2 = {'Meta-Bandit Softmax (500)': (0.2980392156862745,
                                                0.4470588235294118,
                                                0.6901960784313725),
                  'Meta-Bandit UCB (10)': (0.8666666666666667,
```

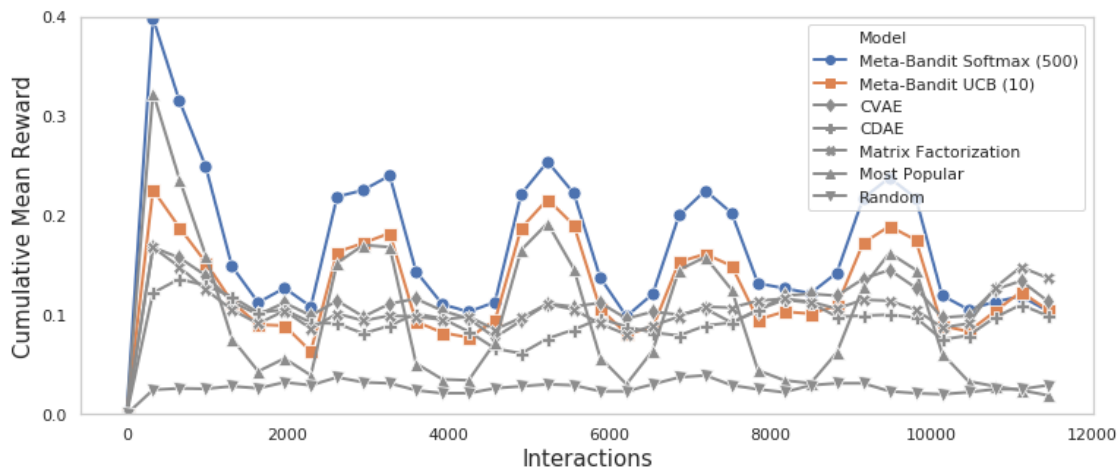
```

0.5176470588235295,
0.3215686274509804),
'CVAE': (0.5490196078431373, 0.5490196078431373, 0.
↪5490196078431373),
'CDAE': (0.5490196078431373, 0.5490196078431373, 0.
↪5490196078431373),
'Matrix Factorization': (0.5490196078431373, 0.5490196078431373, 0.
↪5490196078431373),
'Most Popular': (0.5490196078431373, 0.5490196078431373, 0.
↪5490196078431373),
'Random': (0.5490196078431373, 0.5490196078431373, 0.
↪5490196078431373)}

models = ['Meta-Bandit Softmax (500)',
'Meta-Bandit UCB (10)',
'CVAE', 'CDAE', 'Matrix Factorization', 'Most Popular', 'Random']
df_group = load_dataset(df_models, models, sample_size)
df_group = df_group.groupby(['Model', 'idx']).mean().reset_index()

plot_cum_mean_reward(df_group, column='mean_reward_win',
↪title="plot_cum_mean_reward_all_models_fade", markersize=9,
legend='full', hue_order=models, hue='Model', ylim=0.4,
↪figsize=(12.4, 5), palette=palette2)

```



```

[42]: palette2 = {'Meta-Bandit Softmax (500)': (0.2980392156862745,
0.4470588235294118,
0.6901960784313725),
'Meta-Bandit UCB (10)': (0.8666666666666667,
0.5176470588235295,

```

```

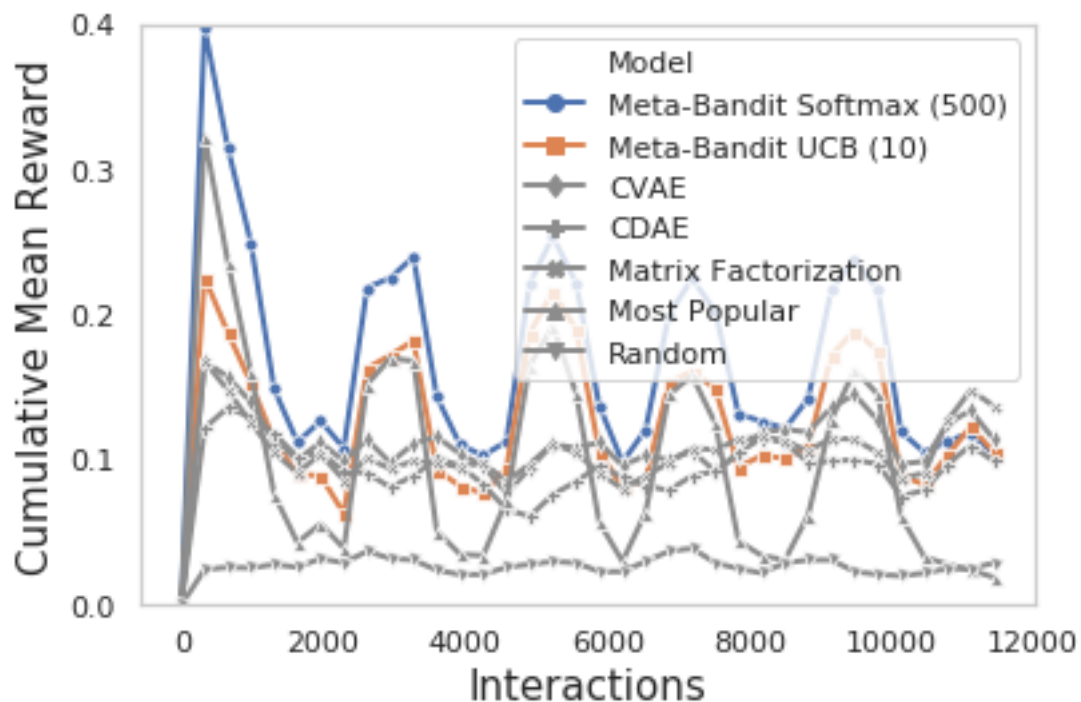
0.3215686274509804),
    'CVAE': (0.5490196078431373, 0.5490196078431373, 0.
↪5490196078431373),
    'CDAE': (0.5490196078431373, 0.5490196078431373, 0.
↪5490196078431373),
    'Matrix Factorization': (0.5490196078431373, 0.5490196078431373, 0.
↪5490196078431373),
    'Most Popular': (0.5490196078431373, 0.5490196078431373, 0.
↪5490196078431373),
    'Random': (0.5490196078431373, 0.5490196078431373, 0.
↪5490196078431373)}

```

```

[43]: models = ['Meta-Bandit Softmax (500)',
    'Meta-Bandit UCB (10)',
    'CVAE', 'CDAE', 'Matrix Factorization', 'Most Popular', 'Random']
df_group = load_dataset(df_models, models, sample_size)
df_group = df_group.groupby(['Model', 'idx']).mean().reset_index()
plot_cum_mean_reward(df_group, column='mean_reward_win',
↪title="plot_cum_mean_reward_all_models_fade",
    legend='full', hue_order=models, hue='Model', ylim=0.4,
↪palette=palette2)

```



```

[ ]:

```

### 1.3 Explorer Bandit

```
[44]: import pandas as pd
import pickle
import re
import sys
import numpy as np
import streamlit as st
import pandas as pd
import numpy as np
import plotly.figure_factory as ff
import plotly.express as px
import plotly.graph_objects as go
import os
import seaborn as sns
import plotly.express as px
```

```
[45]: bandits = ['Meta-Bandit e-greedy (0.1)', 'Meta-Bandit Softmax (500)',
↳ 'Meta-Bandit UCB (10)']
df_group = load_dataset(df_models, bandits, sample_size)
df_group.tail()

df_plot = df_group.sort_values('reward').groupby('bandit').last().reset_index()
df_plot
```

```
[45]:
```

	bandit \
0	Meta-Bandit Softmax (500)
1	Meta-Bandit UCB (10)
2	Meta-Bandit e-greedy (0.1)

		interaction \
0	EnsambleMABInteraction___remote_contextua___endpoints_____83cc906d2c	
1	EnsambleMABInteraction___remote_ucb___endpoints_____c6ad4386c3	
2	EnsambleMABInteraction___remote_contextua___endpoints_____03a780dcaf	

	idx	user	item	reward	index_env	_idx	mean_reward \
0	11472	2731788585	41576972	1928.0	65809128	11473	0.168047
1	11471	2731406796	48558681	1452.0	65797656	11472	0.126569
2	11472	2731788585	41693040	1846.0	65809128	11473	0.160900

	mean_reward_win	Model
0	0.105	Meta-Bandit Softmax (500)
1	0.096	Meta-Bandit UCB (10)
2	0.107	Meta-Bandit e-greedy (0.1)

```
[46]: import gc
gc.collect()
```

[46]: 12953

```
[47]: import pickle
def load_bandit(interaction):
    path = '/media/workspace/DeepFood/deep-reco-gym/output/interaction/
↳EnsambleMABInteraction/results/{}/'.format(interaction)
    bandit = pickle.load(open(path+"/"+bandit.pkl", "rb"))
    return bandit
bandit = load_bandit(df_plot.iloc[0].interaction)
```

```
[48]: def get_arms(bandit):
    arms = np.unique(bandit._arms_selected)
    arms_rewards = bandit._arms_selected
    rounds = len(bandit._arms_selected)
    count_per_arms = {}

    for a in arms:
        count_per_arms[a] = np.zeros(rounds)

    for r in range(rounds):
        count_per_arms[arms_rewards[r]][r] = 1

    return count_per_arms
```

```
[49]: count_per_arms = get_arms(bandit)
count_per_arms
```

```
[49]: {0: array([0., 0., 1., ..., 1., 0., 1.]),
1: array([1., 0., 0., ..., 0., 0., 0.]),
2: array([0., 1., 0., ..., 0., 1., 0.]),
3: array([0., 0., 0., ..., 0., 0., 0.])}
```

```
[50]: def stack_values(count_per_arms, window = 1000):

    values = count_per_arms[0]

    arm1 = pd.Series(count_per_arms[0]).rolling(window = window, min_periods=1).
↳mean()
    arm2 = pd.Series(count_per_arms[1]).rolling(window = window, min_periods=1).
↳mean()
    arm3 = pd.Series(count_per_arms[2]).rolling(window = window, min_periods=1).
↳mean()
    arm4 = pd.Series(count_per_arms[3]).rolling(window = window, min_periods=1).
↳mean()
```

```
data = pd.DataFrame({'arm1': arm1, 'arm2': arm2, 'arm3': arm3, 'arm4':  
↪arm4})  
return data
```

```
data = stack_values(count_per_arms, window = 1000)
```

```
[ ]:
```

```
[51]: bandit._endpoints
```

```
[51]: ('http://localhost:5001/rank',  
      'http://localhost:5003/rank',  
      'http://localhost:5004/rank',  
      'http://localhost:5005/rank')
```

```
[52]: palette
```

```
[52]: {'Meta-Bandit Softmax (500)': (0.2980392156862745,  
    0.4470588235294118,  
    0.6901960784313725),  
      'Meta-Bandit UCB (10)': (0.8666666666666667,  
    0.5176470588235295,  
    0.3215686274509804),  
      'CVAE': (0.3333333333333333, 0.6588235294117647, 0.40784313725490196),  
      'CDAE': (0.7686274509803922, 0.3058823529411765, 0.3215686274509804),  
      'Matrix Factorization': (0.5058823529411764,  
    0.4470588235294118,  
    0.7019607843137254),  
      'Most Popular': (0.5764705882352941, 0.47058823529411764, 0.3764705882352941),  
      'Random': (0.8549019607843137, 0.5450980392156862, 0.7647058823529411)}
```

```
[53]: def plot_exploration(data, title = "exploration_fig.pdf",  
    labels=['Most Popular', 'Matrix Factorization', 'CVAE',  
↪'CDAE'], y_axes=True, legend=True):  
  
    colors=[palette[l] for l in labels]  
    #models = ['CVAE', 'CDAE', 'Matrix Factorization', 'Most Popular',  
↪'Random']  
    plt.figure()  
  
    sns.set(style="darkgrid")  
    plt.xlabel('Interactions', fontsize=15)  
  
    if y_axes:  
        plt.ylabel('Cumulative Mean Exploration', fontsize=15)  
    else:
```



```

plt.ylabel('', fontsize=15)

# We need to transform the data from raw data to percentage (fraction)
data_perc = data.divide(data.sum(axis=1), axis=0)

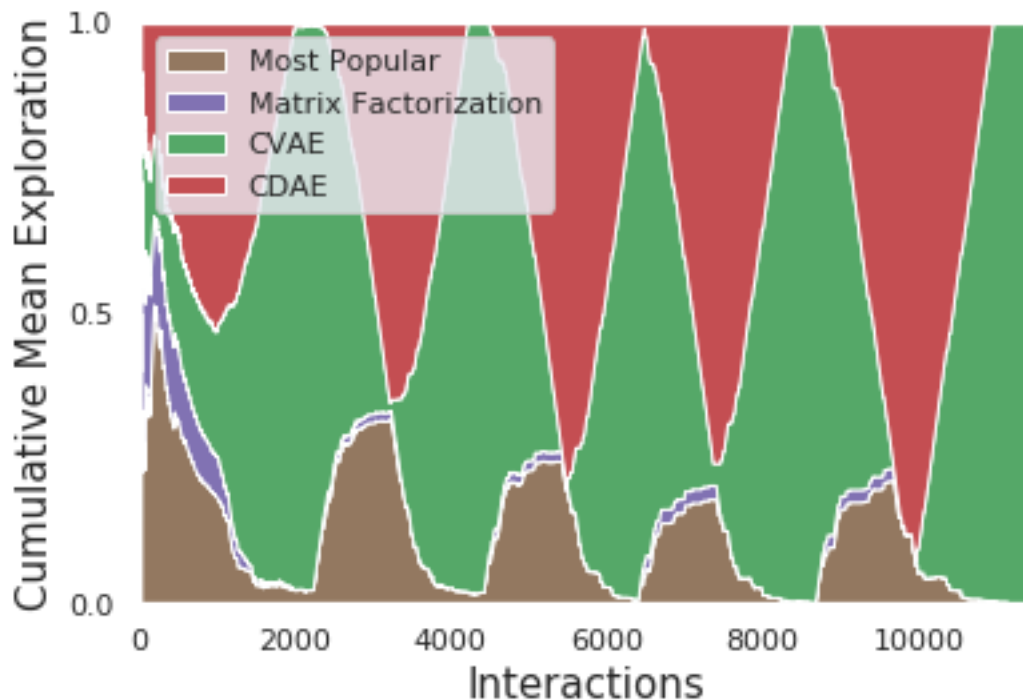
# Make the plot
plt.stackplot(range(len(data)), data_perc["arm1"], data_perc["arm2"],
              data_perc["arm3"], data_perc["arm4"], labels=labels,
              colors=colors)
if legend:
    plt.legend(loc='upper left')
plt.margins(0,0)
plt.yticks([0,0.5,1])

plt.tick_params(labelsize=11)

#plt.legend(bbox_to_anchor=(1.05, 1), loc=2, borderaxespad=0., fontsize=12)
plt.savefig("output/tmp/{}.pdf".format(title), dpi=300, bbox_inches="tight")
plt.show()

plot_exploration(data)

```

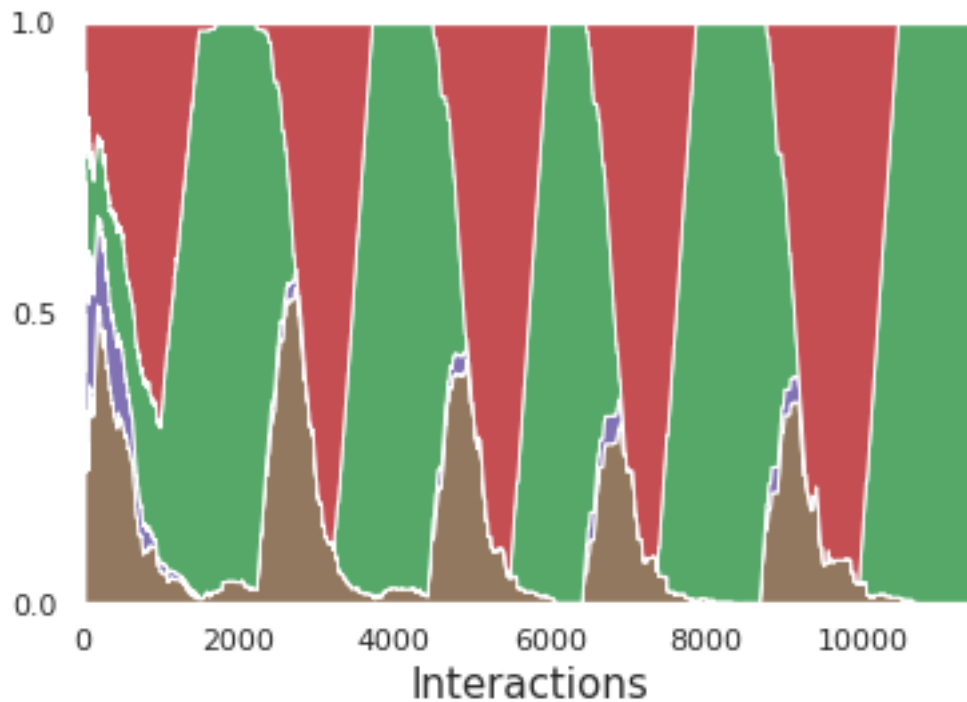


[ ]:

### 1.3.1 Plot

```
[54]: model = df_plot.iloc[0]
print(model.Model)
bandit = load_bandit(model.interaction)
count_per_arms = get_arms(bandit)
data = stack_values(count_per_arms, window = 500)
plot_exploration(data, legend=False, y_axes=False, title = "exploration_fig_{}.pdf".format(model.bandit.replace(" ", "_")))
↪pdf"
```

Meta-Bandit Softmax (500)

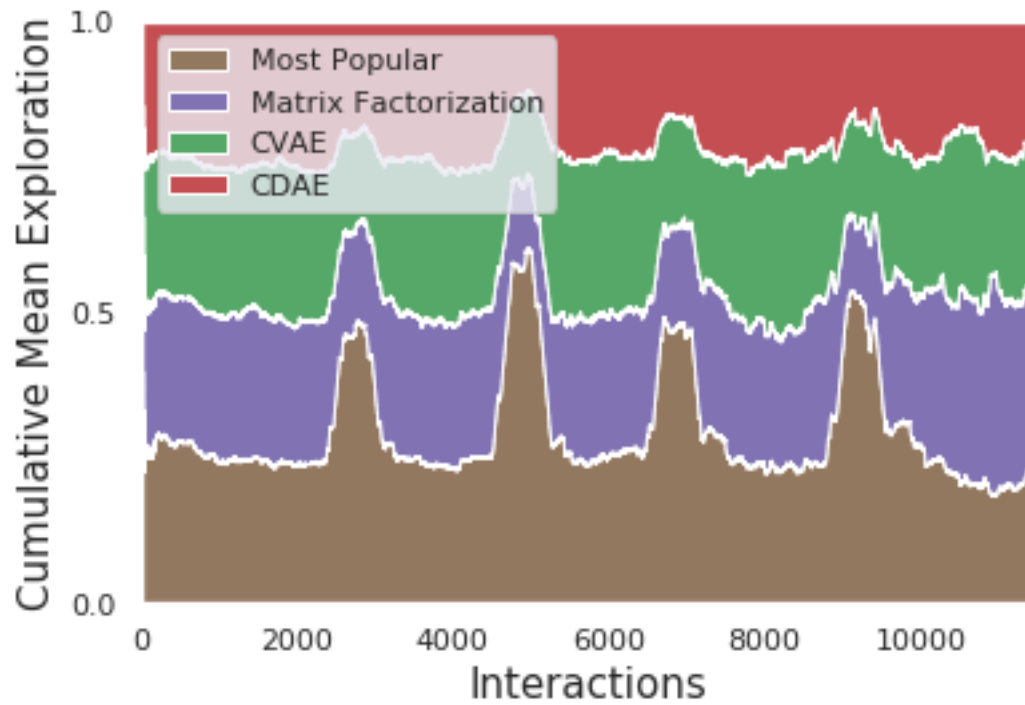


```
[55]: ##
```

```
[56]: model = df_plot.iloc[1]
print(model.Model)

bandit = load_bandit(model.interaction)
count_per_arms = get_arms(bandit)
data = stack_values(count_per_arms, window = 500)
plot_exploration(data, title = "exploration_fig_{}.pdf".format(model.bandit.
↪replace(" ", "_")))
```

Meta-Bandit UCB (10)



```
[57]: model = df_plot.iloc[2]
print(model.Model)
bandit = load_bandit(model.interaction)
count_per_arms = get_arms(bandit)
data = stack_values(count_per_arms, window = 500)
plot_exploration(data, legend=False, y_axes=False, title = "exploration_fig_{}.
↳pdf".format(model.bandit.replace(" ", "_")))
```

Meta-Bandit e-greedy (0.1)

