eval_llm

March 1, 2024

[1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import json
```

[2]:
```
# Loading Common Questions and Hard Questions Evaluation Data
phi_eval_c = pd.DataFrame(json.loads(open("./data/phi2_eval_df_c.json", "r").
 ↪read()))
phi_eval_h = pd.DataFrame(json.loads(open("./data/phi2_eval_hard.json", "r").
 ↪read()))
def_eval_c = pd.DataFrame(json.loads(open("./data/sqlc_eval_df_c.json", "r").
 ↪read()))
def_eval_h = pd.DataFrame(json.loads(open("./data/sqlc_eval_hard.json", "r").
 ↪read()))

# Loading Training Logs for Fine-tuning Phi-2
training_logs = pd.read_csv("./data/training_logs.csv")

phi_eval_c.shape, phi_eval_h.shape, def_eval_c.shape, def_eval_h.shape,␣
 ↪training_logs.shape
```

[2]:
```
((1258, 9), (33, 9), (1258, 9), (33, 9), (31, 3))
```

[ ]:
```

```

[3]:
```
phi_eval = pd.concat([phi_eval_c, phi_eval_h])
def_eval = pd.concat([def_eval_c, def_eval_h])

phi_eval.shape, def_eval.shape
```

[3]:
```
((1291, 9), (1291, 9))
```

[4]:
```
phi_eval.columns
```

[4]:
```
Index(['prompt', 'pred', 'actu', 'inf_time', 'temperature', 'difficulty',
       'token_in', 'token_out', 'tokens_per_sec'],
      dtype='object')
```

[5]:
```
phi_eval['tokens_per_sec'] = (phi_eval['token_in'] + phi_eval['token_out'])/
 ↪phi_eval['inf_time']
def_eval['tokens_per_sec'] = (def_eval['token_in'] + def_eval['token_out'])/
 ↪def_eval['inf_time']

phi_eval['all_tokens'] = phi_eval['token_in'] + phi_eval['token_out']
def_eval['all_tokens'] = def_eval['token_in'] + def_eval['token_out']

phi_eval['question'] = phi_eval['prompt'].apply(lambda x :x.split("`")[1])
def_eval['question'] = def_eval['prompt'].apply(lambda x :x.split("`")[1])

phi_eval['context'] = phi_eval['prompt'].apply(lambda x :x.split("schema:
 ↪\n")[-1].split("\n\n")[0])
def_eval['context'] = def_eval['prompt'].apply(lambda x :x.split("schema:
 ↪\n")[-1].split("\n\n")[0])
```

0.1 Evaluation Plots

0.1.1 Difficulty vs Inference Time

[6]:
```
phi_eval.groupby('difficulty')['inf_time'].mean().reset_index().
 ↪sort_values('inf_time')
```

[6]:

	difficulty	inf_time
0	easy	16.261769
2	medium	20.397285
1	hard	38.548714

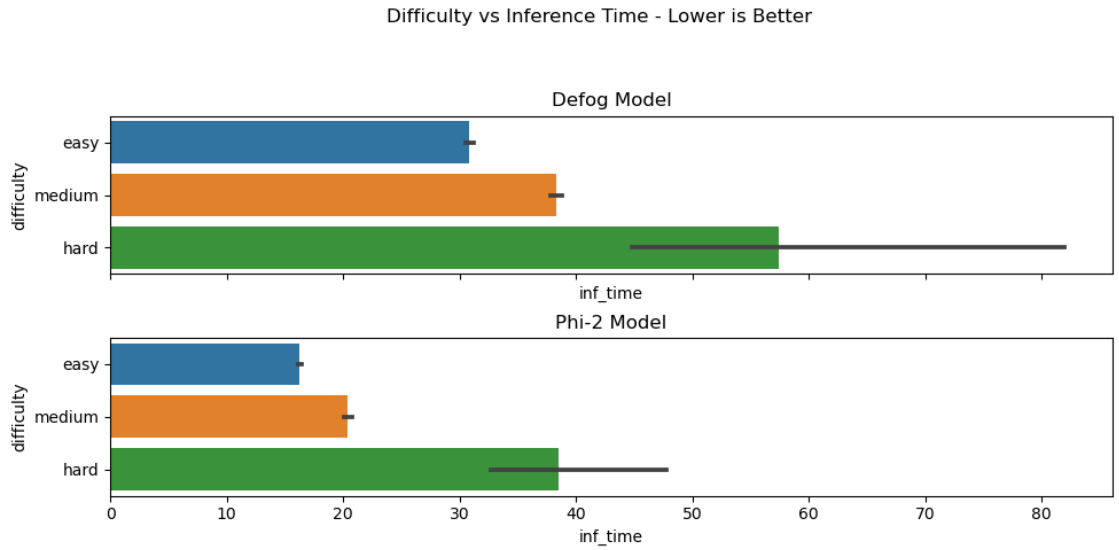
[7]:
```
def_eval.groupby('difficulty')['inf_time'].mean().reset_index().
 ↪sort_values('inf_time')
```

[7]:

	difficulty	inf_time
0	easy	30.854192
2	medium	38.260510
1	hard	57.408160

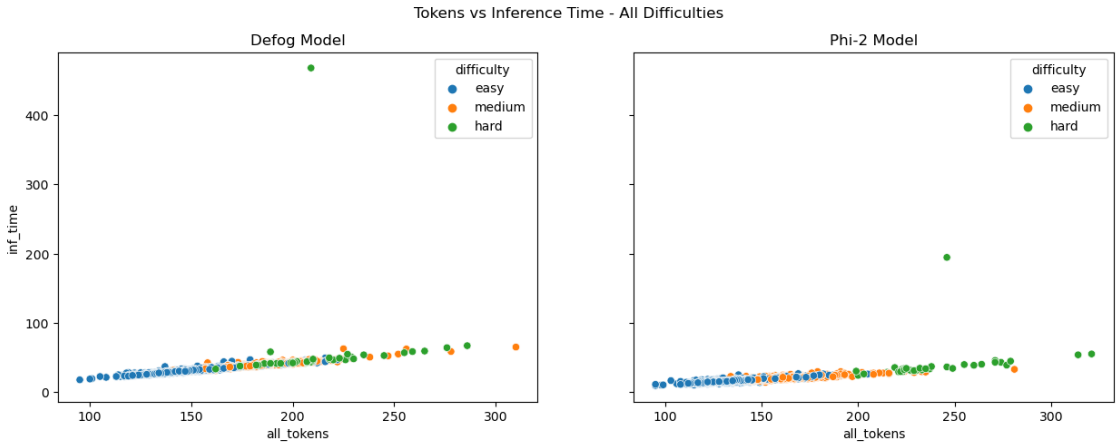
[8]:
```
# diffculty vs inf_time - bar
figure, axes = plt.subplots(2, 1, sharex=True,
                            figsize=(10, 5))
figure.suptitle('Difficulty vs Inference Time - Lower is Better')
figure.tight_layout(pad=3)

axes[0].set_title('Defog Model')
sns.barplot(def_eval, y="difficulty", x="inf_time", ax=axes[0])

axes[1].set_title('Phi-2 Model')
sns.barplot(phi_eval, y="difficulty", x="inf_time", ax=axes[1])
```

```
plt.savefig('./out_images/'+'Difficulty vs Inference Time.png',␣
 ↪bbox_inches='tight')
```

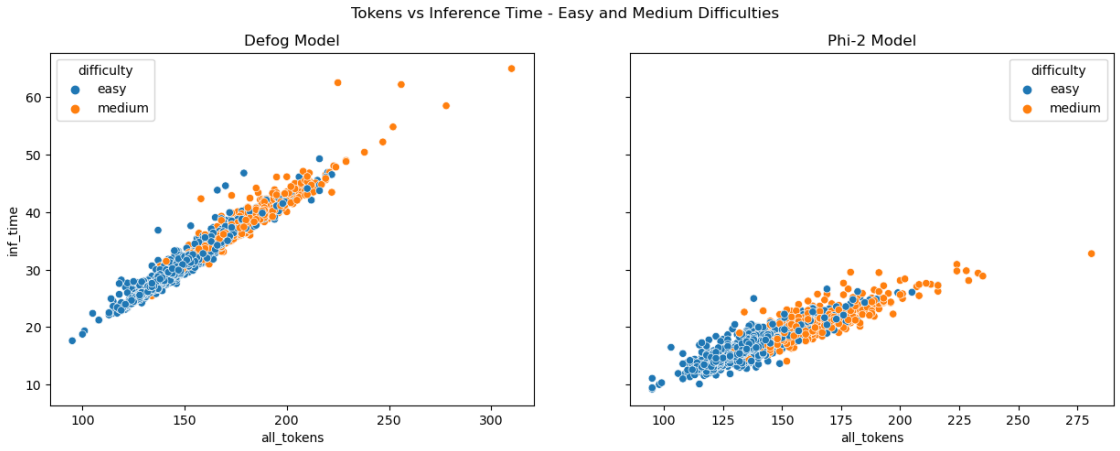


0.1.2 Number of Tokens vs Inference Time

[9]:
```
# tokens vs inf_time
figure, axes = plt.subplots(1, 2, sharey=True,
                            figsize=(15, 5))
figure.suptitle('Tokens vs Inference Time - All Difficulties')

axes[0].set_title('Defog Model')
sns.scatterplot(def_eval, x="all_tokens", y="inf_time", hue="difficulty",␣
 ↪ax=axes[0])

axes[1].set_title('Phi-2 Model')
sns.scatterplot(phi_eval, x="all_tokens", y="inf_time", hue="difficulty",␣
 ↪ax=axes[1])
plt.savefig('./out_images/'+'Tokens vs Inference Time', bbox_inches='tight')
```



[10]:
```
# tokens vs inf_time
figure, axes = plt.subplots(1, 2, sharey=True,
                            figsize=(15, 5))
figure.suptitle('Tokens vs Inference Time - Easy and Medium Difficulties')

axes[0].set_title('Defog Model')
sns.scatterplot(def_eval[def_eval['difficulty'].isin(['easy', 'medium'])],␣
 ↪x="all_tokens", y="inf_time", hue="difficulty", ax=axes[0])

axes[1].set_title('Phi-2 Model')
sns.scatterplot(phi_eval[phi_eval['difficulty'].isin(['easy', 'medium'])],␣
 ↪x="all_tokens", y="inf_time", hue="difficulty", ax=axes[1])
plt.savefig('./out_images/'+'Tokens vs Inference Time - Easy and Medium␣
 ↪Difficulties', bbox_inches='tight')
```



0.1.3 Number of Tokens per Sec vs Difficulty

[11]:
```
phi_eval.groupby('difficulty')['tokens_per_sec'].mean().reset_index().
 ↪sort_values('tokens_per_sec')
```

[11]:

	difficulty	tokens_per_sec
1	hard	6.829720
2	medium	8.058363
0	easy	8.390820

[12]:
```
def_eval.groupby('difficulty')['tokens_per_sec'].mean().reset_index().
 ↪sort_values('tokens_per_sec')
```

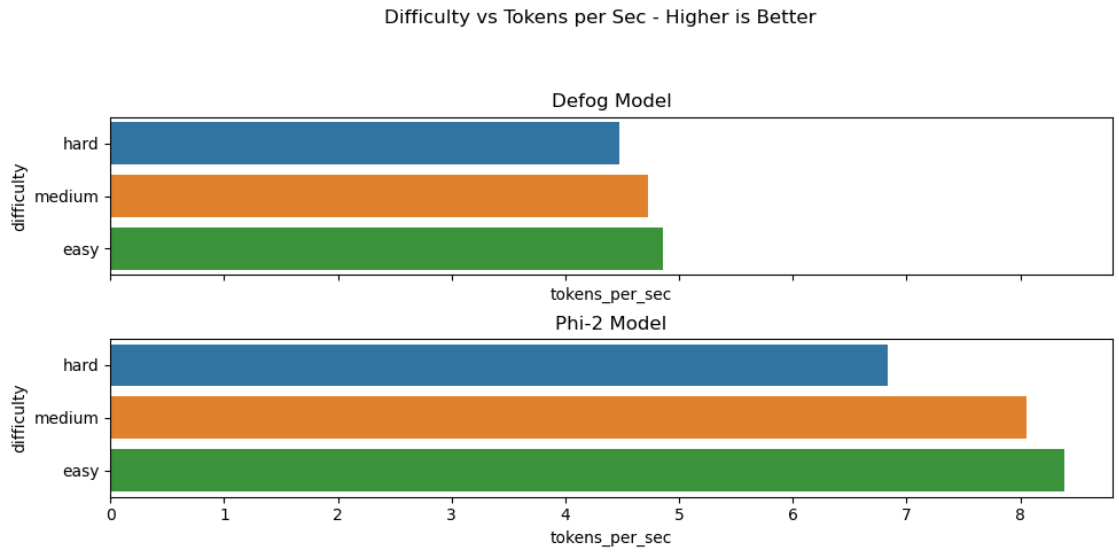
[12]:

	difficulty	tokens_per_sec
1	hard	4.474975
2	medium	4.726500
0	easy	4.854409

[45]:
```
round((8.390820-4.854409)/8.390820,5)*100, round((8.058363-4.726500)/8.
 ↪058363,5)*100, round((6.829720-4.474975)/6.829720,5)*100
```

[45]:
```
(42.146, 41.347, 34.477999999999994)
```

[13]:
```
# diffculty vs tokens_per_inf_time - bar
figure, axes = plt.subplots(2, 1, sharex=True,
                            figsize=(10, 5))
figure.suptitle('Difficulty vs Tokens per Sec - Higher is Better')
figure.tight_layout(pad=3)

axes[0].set_title('Defog Model')
sns.barplot(def_eval.groupby('difficulty')['tokens_per_sec'].mean().
 ↪reset_index().sort_values('tokens_per_sec'),y="difficulty",␣
 ↪x="tokens_per_sec", ax=axes[0])

axes[1].set_title('Phi-2 Model')
sns.barplot(phi_eval.groupby('difficulty')['tokens_per_sec'].mean().
 ↪reset_index().sort_values('tokens_per_sec'),y="difficulty",␣
 ↪x="tokens_per_sec", ax=axes[1])
plt.savefig('./out_images/'+'Difficulty vs Tokens per Sec', bbox_inches='tight')
```



0.1.4 Tokens Generated vs Difficulty

[47]:
```
phi_eval.groupby('difficulty')['token_out'].mean().reset_index().
  ↪sort_values('token_out')
```

[47]:

	difficulty	token_out
0	easy	25.839450
2	medium	33.673684
1	hard	81.692308

[48]:
```
def_eval.groupby('difficulty')['token_out'].mean().reset_index().
  ↪sort_values('token_out')
```

[48]:

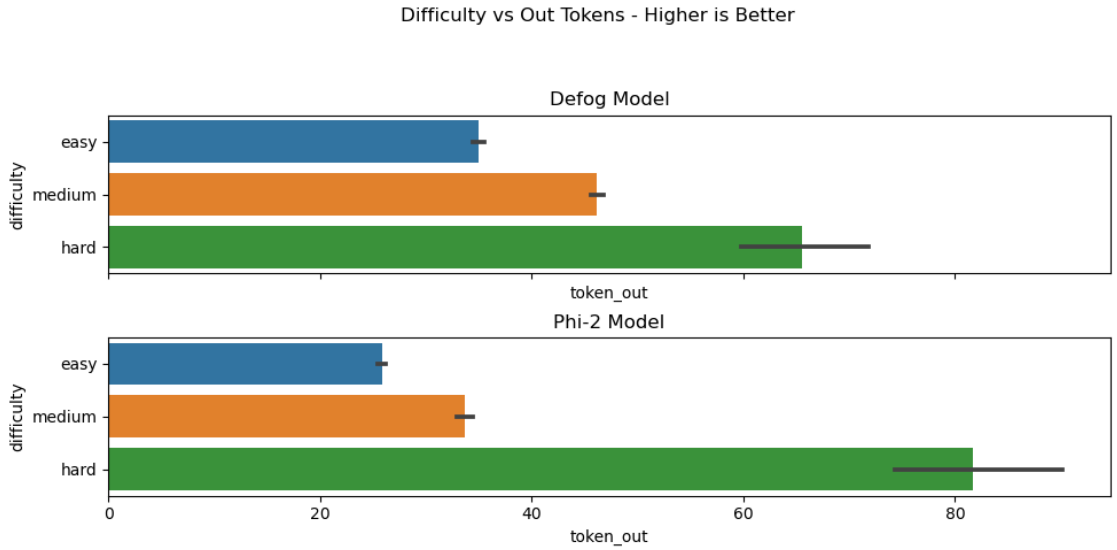
	difficulty	token_out
0	easy	34.969037
2	medium	46.142105
1	hard	65.538462

[49]:
```
round((34.969037-25.839450)/34.969037,5)*100, round((46.142105-33.673684)/46.
  ↪142105,5)*100, round((65.538462-81.692308)/81.692308,5)*100
```

[49]:
```
(26.107999999999997, 27.022000000000002, -19.774)
```

[14]:
```
# diffculty vs out tokens - bar
figure, axes = plt.subplots(2, 1, sharex=True,
                            figsize=(10, 5))
figure.suptitle('Difficulty vs Out Tokens - Higher is Better')
figure.tight_layout(pad=3)
```

```
axes[0].set_title('Defog Model')
sns.barplot(def_eval, y="difficulty", x="token_out", ax=axes[0])

axes[1].set_title('Phi-2 Model')
sns.barplot(phi_eval, y="difficulty", x="token_out", ax=axes[1])
plt.savefig('./out_images/'+'Difficulty vs Out Tokens', bbox_inches='tight')
```



0.1.5 Execution Success

[69]:
```
import sqlite3

## Create DB schema based on context and run the query to check for execution.
def execution_test(row):
    conn = sqlite3.connect(':memory:')
    script = row['context']
    success = True
    try:
        conn.executescript(script)
        sql_query = pd.read_sql_query(row['pred'], conn)
    except:
        success = False
    return success

phi_eval['exec_success'] = phi_eval.apply(lambda x: execution_test(x), axis=1).
 ↪map({True: '1', False: '0'})
def_eval['exec_success'] = def_eval.apply(lambda x: execution_test(x), axis=1).
 ↪map({True: '1', False: '0'})
```

```
phi_eval['exec_success_int'] = phi_eval.apply(lambda x: execution_test(x),␣
 ↪axis=1).map({True: 1, False: 0})
def_eval['exec_success_int'] = def_eval.apply(lambda x: execution_test(x),␣
 ↪axis=1).map({True: 1, False: 0})
```

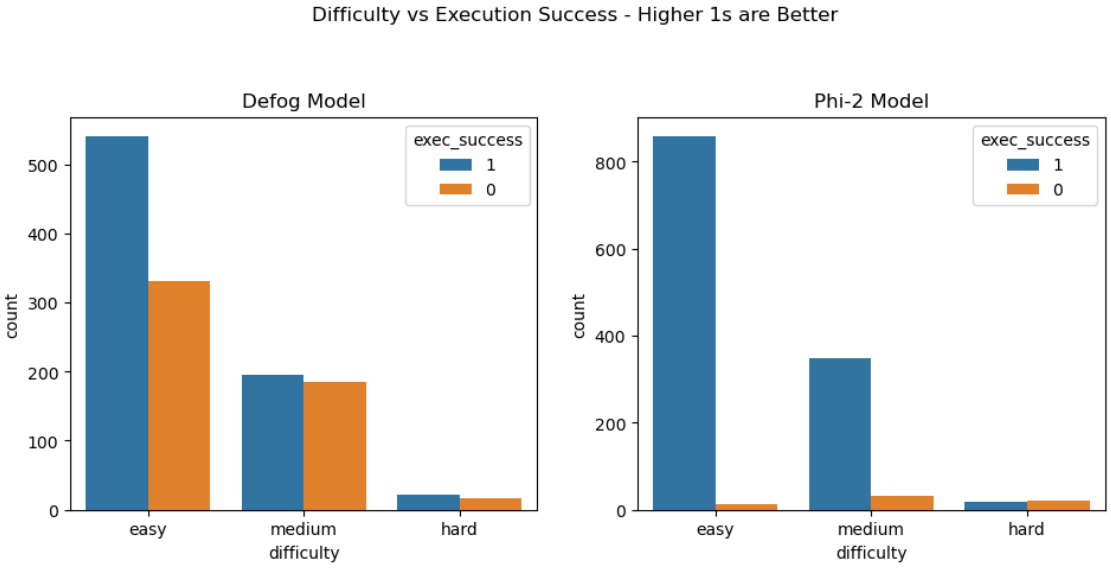
[75]:
```
phi_eval.groupby('difficulty')['exec_success_int'].mean().reset_index().
 ↪sort_values('exec_success_int'), def_eval.
 ↪groupby('difficulty')['exec_success_int'].mean().reset_index().
 ↪sort_values('exec_success_int')
```

[75]:
```
(  difficulty  exec_success_int
 1       hard          0.487179
 2     medium          0.918421
 0       easy          0.985092,
   difficulty  exec_success_int
 2     medium          0.513158
 1       hard          0.564103
 0       easy          0.620413)
```

[77]:
```
round((22-19)/22,5)*100, round((349-195)/349,5)*100, round((859-541)/
 ↪859,5)*100, (98+91+48)/300, (62+56+51)/300
```

[77]:
```
(13.636000000000001, 44.126, 37.019999999999996, 0.79, 0.5633333333333334)
```

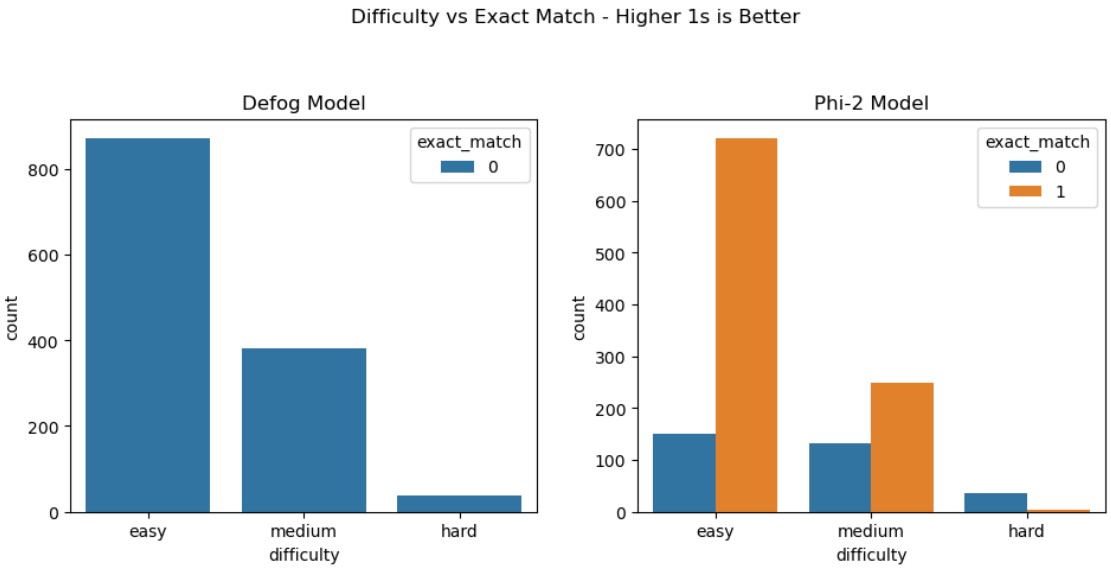
[25]:
```
# diffculty vs inf_time - bar
figure, axes = plt.subplots(1, 2, sharex=True,
                            figsize=(10, 5))
figure.suptitle('Difficulty vs Execution Success - Higher 1s are Better')
figure.tight_layout(pad=3)

axes[0].set_title('Defog Model')
sns.countplot(def_eval, x="difficulty", ax=axes[0], hue="exec_success",␣
 ↪hue_order="10")

axes[1].set_title('Phi-2 Model')
sns.countplot(phi_eval, x="difficulty", ax=axes[1], hue="exec_success")

plt.savefig('./out_images/'+'Difficulty vs Execution Success',␣
 ↪bbox_inches='tight')
```



0.1.6 Exact Matches

[17]:
```
## Check perfect matches based on the actual value
phi_eval['exact_match'] = phi_eval['pred'].str.lower().str.strip() ==␣
 ↪phi_eval['actu'].str.lower().str.strip()
def_eval['exact_match'] = def_eval['pred'].str.lower().str.strip() ==␣
 ↪def_eval['actu'].str.lower().str.strip()

phi_eval['exact_match'] = phi_eval['exact_match'].map({True: '1', False: '0'})
def_eval['exact_match'] = def_eval['exact_match'].map({True: '1', False: '0'})
```

[18]:
```
# diffculty vs inf_time - bar
figure, axes = plt.subplots(1, 2, sharex=True,figsize=(10, 5))
figure.suptitle('Difficulty vs Exact Match - Higher 1s is Better')
figure.tight_layout(pad=3)

axes[0].set_title('Defog Model')
sns.countplot(def_eval, x="difficulty", ax=axes[0], hue="exact_match")

axes[1].set_title('Phi-2 Model')
sns.countplot(phi_eval, x="difficulty", ax=axes[1], hue="exact_match")

plt.savefig('./out_images/'+'Difficulty vs Exact Match', bbox_inches='tight')
```



0.1.7 Training Logs

[19]:
```
training_logs['train_accuracy'] = 1 - training_logs['Training Loss']
training_logs['val_accuracy'] = 1 - training_logs['Validation Loss']
```

[20]:
```
training_logs.columns = ['step', 'train_loss', 'val_loss', 'train_accuracy',␣
 ↪'val_accuracy']
```

[21]:
```
# training_logs
figure, axes = plt.subplots(1, 1, sharex=True,figsize=(10, 5))
figure.suptitle('Training and Validation Accuracy vs Steps')
sns.lineplot(data=training_logs, y="train_accuracy", x="step", label="train␣
 ↪accuracy")
sns.lineplot(data=training_logs, y="val_accuracy", x="step", label="validation␣
 ↪accuracy")

plt.savefig('./out_images/'+'Training and Validation Accuracy vs Steps',␣
 ↪bbox_inches='tight')
```

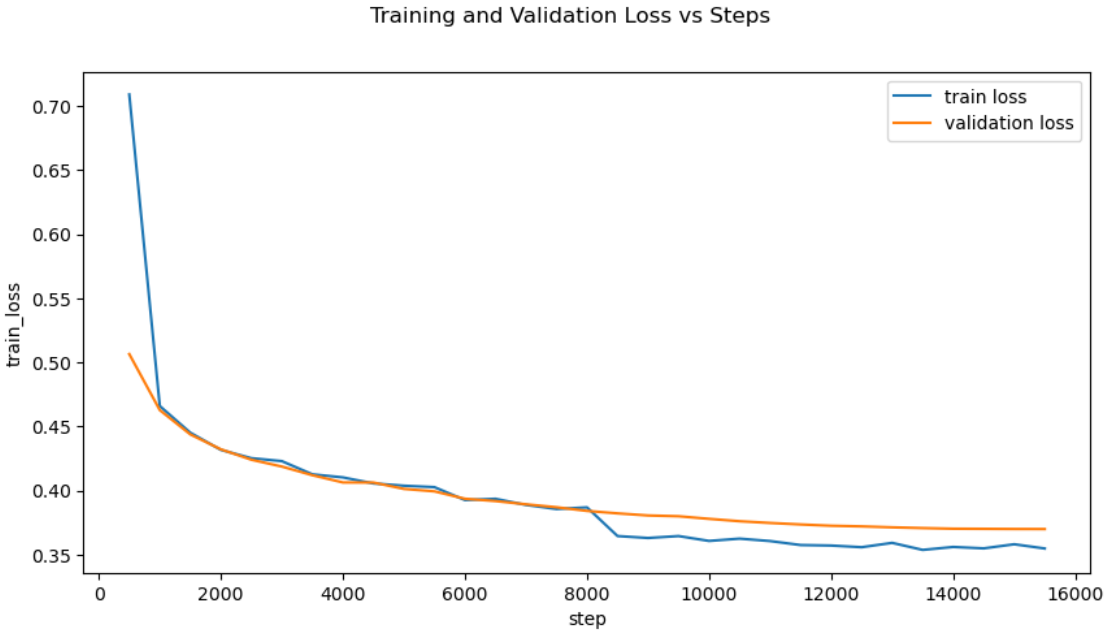
```
C:\Users\pavan\anaconda3\envs\phi2\Lib\site-packages\seaborn\_oldcore.py:1119:
FutureWarning: use_inf_as_na option is deprecated and will be removed in a
future version. Convert inf values to NaN before operating instead.
  with pd.option_context('mode.use_inf_as_na', True):
C:\Users\pavan\anaconda3\envs\phi2\Lib\site-packages\seaborn\_oldcore.py:1119:
FutureWarning: use_inf_as_na option is deprecated and will be removed in a
future version. Convert inf values to NaN before operating instead.
  with pd.option_context('mode.use_inf_as_na', True):
C:\Users\pavan\anaconda3\envs\phi2\Lib\site-packages\seaborn\_oldcore.py:1119:
```

```
FutureWarning: use_inf_as_na option is deprecated and will be removed in a
future version. Convert inf values to NaN before operating instead.
  with pd.option_context('mode.use_inf_as_na', True):
C:\Users\pavan\anaconda3\envs\phi2\Lib\site-packages\seaborn\_oldcore.py:1119:
FutureWarning: use_inf_as_na option is deprecated and will be removed in a
future version. Convert inf values to NaN before operating instead.
  with pd.option_context('mode.use_inf_as_na', True):
```

[22]:
```
# training_logs
figure, axes = plt.subplots(1, 1, sharex=True,figsize=(10, 5))
figure.suptitle('Training and Validation Loss vs Steps')
sns.lineplot(data=training_logs, y="train_loss", x="step", label="train loss")
sns.lineplot(data=training_logs, y="val_loss", x="step", label="validation␣
 ↪loss")

plt.savefig('./out_images/'+'Training and Validation Loss vs Steps',␣
 ↪bbox_inches='tight')
```

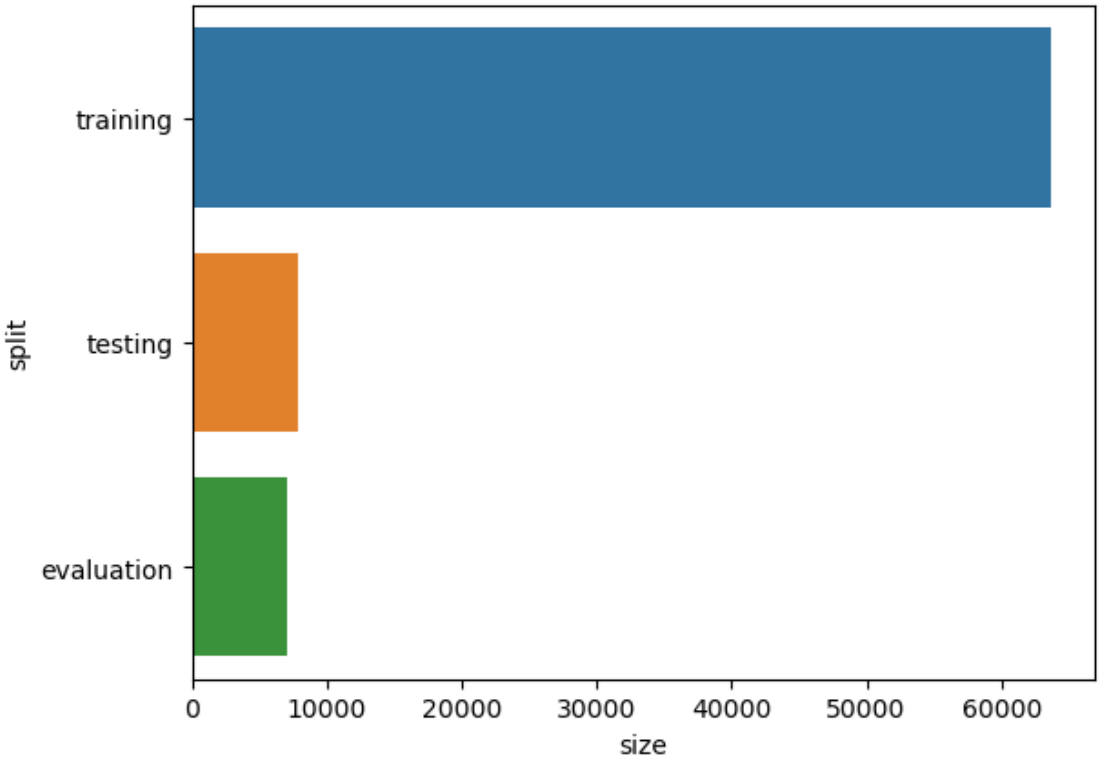
```
C:\Users\pavan\anaconda3\envs\phi2\Lib\site-packages\seaborn\_oldcore.py:1119:
FutureWarning: use_inf_as_na option is deprecated and will be removed in a
future version. Convert inf values to NaN before operating instead.
  with pd.option_context('mode.use_inf_as_na', True):
C:\Users\pavan\anaconda3\envs\phi2\Lib\site-packages\seaborn\_oldcore.py:1119:
FutureWarning: use_inf_as_na option is deprecated and will be removed in a
future version. Convert inf values to NaN before operating instead.
  with pd.option_context('mode.use_inf_as_na', True):
C:\Users\pavan\anaconda3\envs\phi2\Lib\site-packages\seaborn\_oldcore.py:1119:
```

```
FutureWarning: use_inf_as_na option is deprecated and will be removed in a
future version. Convert inf values to NaN before operating instead.
  with pd.option_context('mode.use_inf_as_na', True):
C:\Users\pavan\anaconda3\envs\phi2\Lib\site-packages\seaborn\_oldcore.py:1119:
FutureWarning: use_inf_as_na option is deprecated and will be removed in a
future version. Convert inf values to NaN before operating instead.
  with pd.option_context('mode.use_inf_as_na', True):
```



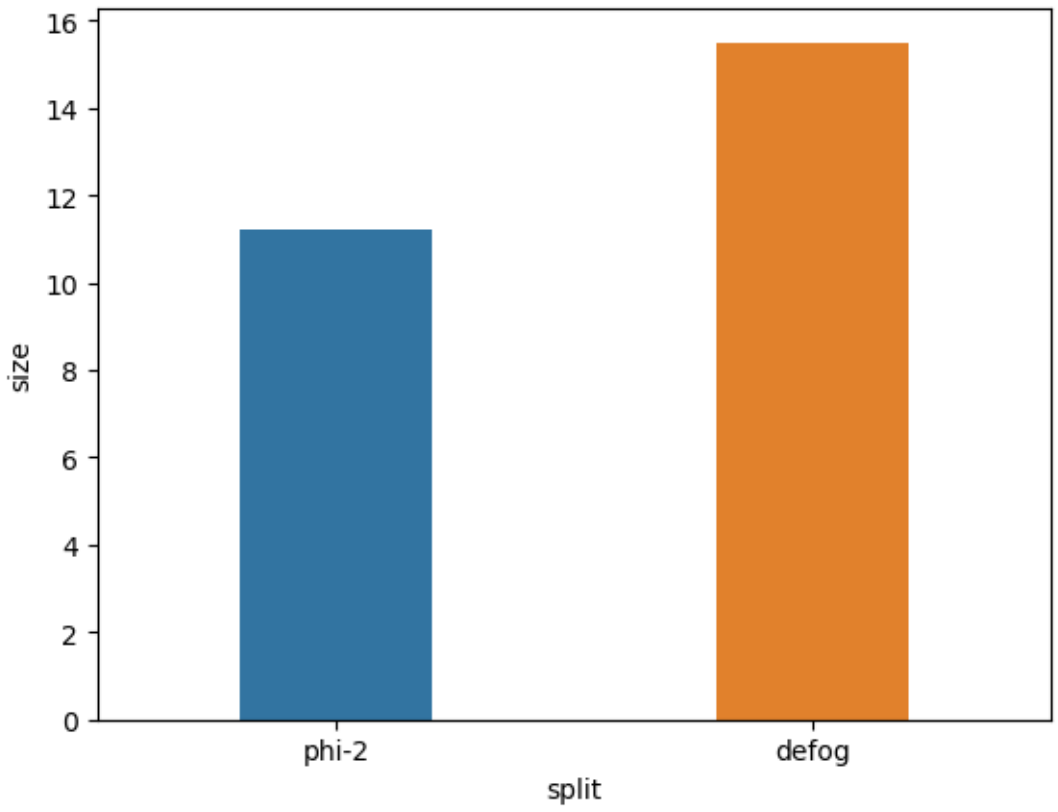
[23]:
```
shapes = pd.DataFrame({"split": ["training", "testing", "evaluation"], "size":␣
↪[63647, 7858, 7072]}, index=[1, 2, 3])
sns.barplot(shapes, y="split", x="size")
```

[23]:
```
<Axes: xlabel='size', ylabel='split'>
```



[35]:
```
usage = pd.DataFrame({"split": ["phi-2", "defog"], "size": [11.2, 15.5]},␣
↪index=[1, 2])
sns.barplot(usage, x="split", y="size",width=0.4)
```

[35]: <Axes: xlabel='split', ylabel='size'>


16
14
12
10
8
6
4
2
0
size
phi-2
defog
split

[ ]: