models_validation_mix_16_set

September 20, 2023

```
[ ]: import tensorflow as tf

from tensorflow.keras import datasets, layers, models
import matplotlib.pyplot as plt
import numpy as np
import pandas as pd
import skimage.measure

import random
import copy
import math
import cv2
import os
```

1 TRAINED MODELS

1.1 Loading of the models

```
[ ]: model = tf.keras.models.load_model('IRI_models/16set_8px_steps_only_paths_mix')

model1 = tf.keras.models.load_model('IRI_models/16set_8px_steps_only_vels_mix')

model2 = tf.keras.models.load_model('IRI_models/16set_8px_steps_only_stops_mix')
```

2 Variables definition

```
[ ]: div = 32
     step = int(32/4)
     red = [5,5,2,2,2,2,2,2]

     sem_dict = ['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree',␣
      ↪'restricted', 'grass']
     chans = len(sem_dict)+1

     lut_in = [0, 20, 50, 100, 150, 255]
     lut_out = [0, 100, 180, 220, 240, 255]
     lut_8u = np.interp(np.arange(0, 256), lut_in, lut_out).astype(np.uint8)
```

2.1 Testing closed corridors (completely or partially closed)

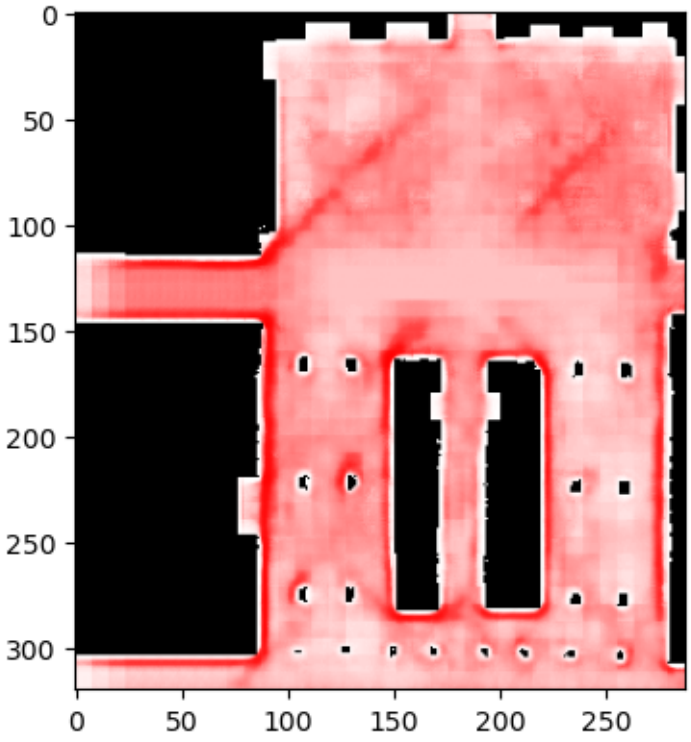
```
[ ]: map_list = ['master_big','master_big_closed','master_big_semiclosed']
     map_root_name = 'master_big'

     for map_name in map_list:
       print(map_name)

       lines = 0
       with open('maps/semantics/'+map_root_name+'/'+map_name+'.csv') as f:
         lines = f.readlines()

       h = len(lines)
       w = len(lines[0].split(','))

       # Converts data to a list of integers
       map = []
       for line in lines:
         map.extend([int(c) for c in line.split(',')])

       for lab_class in sem_dict:
         lines = 0
         try:
           with open('maps/semantics/'+map_root_name+'/
      ↪'+map_root_name+'_sem_'+lab_class+'.csv') as f:
             lines = f.readlines()

           hh = len(lines)
           ww = len(lines[0].split(','))

           if hh != h or ww != w:
             print(f'h: {h}\tw: {w}')
             print(f'h: {hh}\tw: {ww}')
             raise SystemExit("ERROR: Different sizes!!")
```

```
    # Converts data to a list of integers
    for line in lines:
      map.extend([int(c) for c in line.split(',')])

  except FileNotFoundError:
    for i in range(h):
      for j in range(w):
        map.extend([255])

map = np.reshape(map,[chans,h,w])
map = np.moveaxis(map, 0, -1)
map = map/255

map_aux = map
map = np.zeros((int(math.ceil(h/2)),int(math.ceil(w/2)),chans))

for idx in range(chans):
  map[:,:,idx] = skimage.measure.block_reduce(map_aux[:,:,idx], (2,2), np.max)
h, w, _ = map.shape

diff_h = int((h-div*int(h/div))/2)
r_h = int((h-div*int(h/div))%2) + diff_h
diff_w = int((w-div*int(w/div))/2)
r_w = int((w-div*int(w/div))%2) + diff_w
map = map[r_h:-diff_h:,r_w+diff_w:,:]

# print(map.shape)
h, w, _ = map.shape

#␣
↪-------------------------------------------------------------------------------
# creating subplot and figure
fig = plt.figure(figsize=(w/70,h/70))
data_pred = np.zeros((int(math.ceil(h)),int(math.ceil(w))))

step = int(32/4)
for i in np.arange((w/step+int(div/step-1))*(h/step+int(div/step-1))):
  c = int(i%(w/step+int(div/step-1))) - int(div/step-1)*0
  r = int(i/(w/step+int(div/step-1))) - int(div/step-1)*0
  submap = map[max(step*r,0):step*r+div, max(step*c,0):step*c+div,:]
  subdata = model.predict(np.expand_dims(submap,axis=0),verbose=0)[:,:,:,0]
  subdata = np.squeeze(subdata,axis=0)
  data_pred[max(step*r,0):step*r+div, max(step*c,0):step*c+div] += subdata*1/
↪(int(div/step)*int(div/step))
contrasted_data = cv2.LUT((data_pred/np.max(data_pred)*255).astype(np.uint8),␣
↪lut_8u).astype(float)/255
```

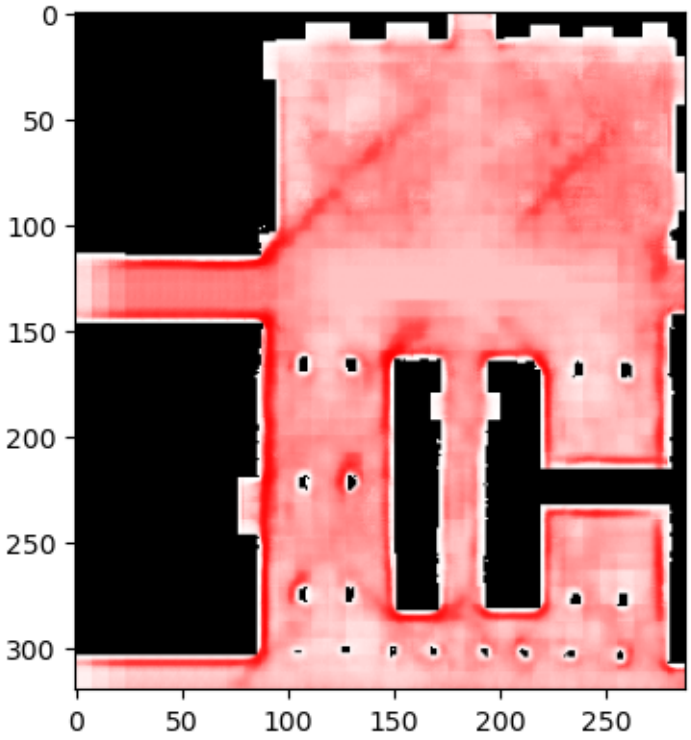
```
 plt.imshow(np.multiply(np.stack((map[:,:,0],map[:,:,0],map[:,:,0]),axis=2),␣
↪np.stack((np.full(contrasted_data.
↪shape,1),1-contrasted_data,1-contrasted_data),axis=2)), vmin=0, vmax=1)
 # plt.imshow(np.multiply(np.stack((map[:,:,0],map[:,:,0],map[:,:,0]),axis=2),␣
↪np.stack((np.full(data_pred.shape,1),1-data_pred,1-data_pred),axis=2)),␣
↪vmin=0, vmax=1)
 plt.show()
```

```
master_big
```

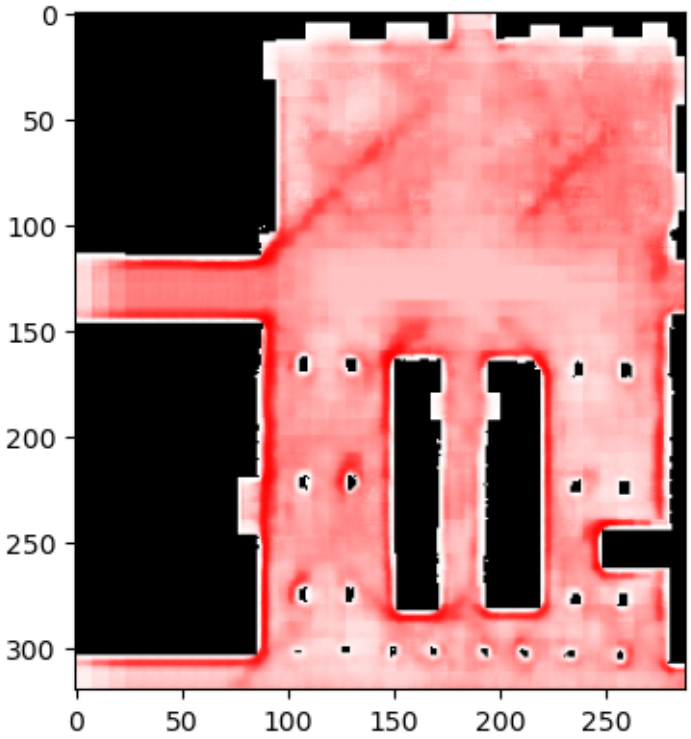
```
2023-09-20 08:55:24.763587: W
tensorflow/tsl/platform/profile_utils/cpu_utils.cc:128] Failed to get CPU
frequency: 0 Hz
```




```
master_big_closed
```



master_big_semiclosed



2.2 Model 1 testing

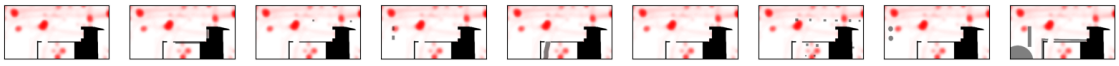
[ ]:
```
map_list = ['stanford_coupa0',␣
 ↪'stanford_coupa3','master_big','willow','map1','map2','costacafe','map3']
kl1 = []

for map_count, map_name in enumerate(map_list):
  print(map_name)

  lines = 0
  with open('maps/semantics/'+map_name+'/'+map_name+'.csv') as f:
    lines = f.readlines()

  h = len(lines)
  w = len(lines[0].split(','))

  # Converts data to a list of integers
  map = []
  for line in lines:
    map.extend([int(c) for c in line.split(',')])

  for lab_class in sem_dict:
    lines = 0
    try:
      with open('maps/semantics/'+map_name+'/'+map_name+'_sem_'+lab_class+'.
 ↪csv') as f:
        lines = f.readlines()

      hh = len(lines)
      ww = len(lines[0].split(','))

      if hh != h or ww != w:
        print(f'h: {h}\tw: {w}')
        print(f'h: {hh}\tw: {ww}')
        raise SystemExit("ERROR: Different sizes!!")

      # Converts data to a list of integers
      for line in lines:
        map.extend([int(c) for c in line.split(',')])

    except FileNotFoundError:
      for i in range(h):
        for j in range(w):
          map.extend([255])
```

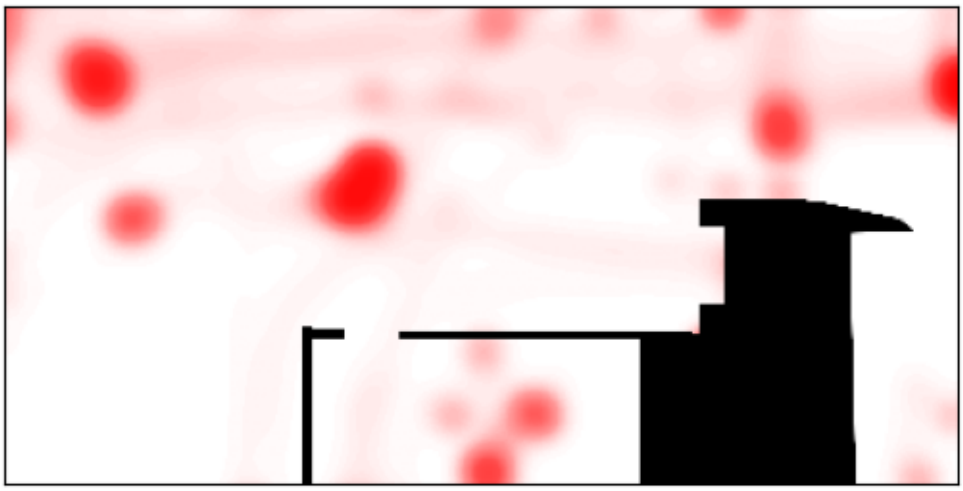
```
  map = np.reshape(map,[chans,h,w])
  map = np.moveaxis(map, 0, -1)
  map = map/255

  map_aux = map
  map = np.zeros((int(math.ceil(h/red[map_count])),int(math.ceil(w/
↪red[map_count])),chans))

  for idx in range(chans):
    map[:,:,idx] = skimage.measure.block_reduce(map_aux[:,:,idx],␣
↪(red[map_count],red[map_count]), np.max)
  h, w, _ = map.shape

  diff_h = int((h-div*int(h/div))/2)
  r_h = int((h-div*int(h/div))%2) + diff_h
  diff_w = int((w-div*int(w/div))/2)
  r_w = int((w-div*int(w/div))%2) + diff_w
  map = map[r_h:-diff_h:,r_w+diff_w:,:]

  # print(map.shape)
  h, w, _ = map.shape

#␣
↪-------------------------------------------------------------------------------
  lines = 0
  with open('maps/semantics/'+map_name+'/humandensity-'+map_name+'-new.csv') as␣
↪f:
    lines = f.readlines()

  hd = len(lines)
  wd = len(lines[0].split(','))

  # Converts data to a list of integers
  data = []
  for line in lines:
    data.extend([int(c) for c in line.split(',')])

  data = np.reshape(data,[hd,wd])
  sigma = 2.0
  data = skimage.filters.gaussian(data+(data==0), sigma=(sigma, sigma),␣
↪channel_axis=-1)*(data>0)
  data = skimage.measure.block_reduce(data, (red[map_count],red[map_count]), np.
↪max)
  data = data[r_h:-diff_h,r_w+diff_w:]
```

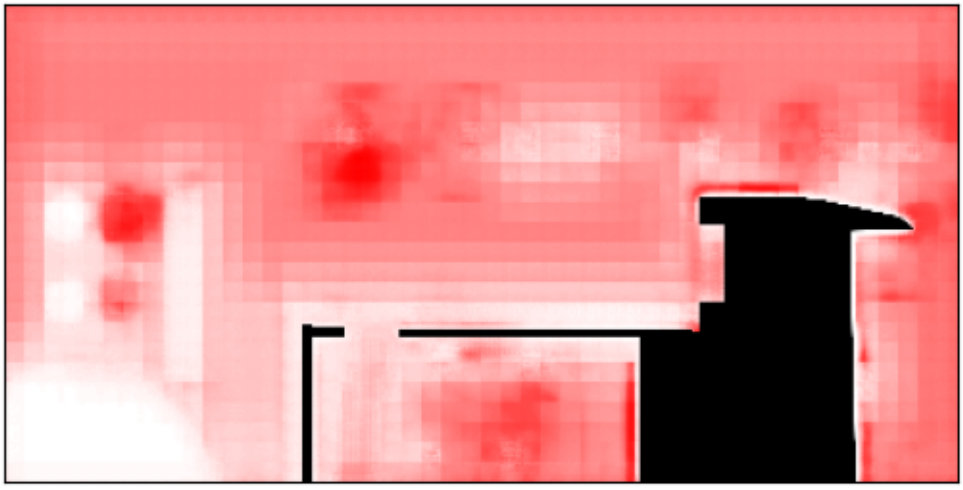
```
data = np.subtract(data, np.full((h, w), np.min(data)))/(np.max(data)-np.
↪min(data))

# print(data.shape)
hd, wd = data.shape

print(sem_dict)
plt.figure(figsize=(20,5))
for i in range(len(sem_dict)):
  i = i+1
  ax = plt.subplot(1, len(sem_dict), i)
  alp = 0.5
  contrasted_data = cv2.LUT((data/np.max(data)*255).astype(np.uint8), lut_8u).
↪astype(float)/255
  ax.imshow(np.multiply(np.stack((map[:,:,0],map[:,:,0],map[:,:
↪,0]),axis=2),np.multiply(np.stack((map[:,:,i],map[:,:,i],map[:,:
↪,i]),axis=2)*alp+(1-alp), np.stack((np.full(contrasted_data.
↪shape,1),1-contrasted_data,1-contrasted_data),axis=2))), vmin=0, vmax=1)
  # ax.imshow(np.multiply(np.stack((map[:,:,0],map[:,:,0],map[:,:
↪,0]),axis=2),np.multiply(np.stack((map[:,:,i],map[:,:,i],map[:,:
↪,i]),axis=2)*alp+(1-alp), np.stack((np.full(data.
↪shape,1),1-data,1-data),axis=2))), vmin=0, vmax=1)
  ax.get_xaxis().set_visible(False)
  ax.get_yaxis().set_visible(False)
plt.show()

ax = plt.subplot(111)
contrasted_data = cv2.LUT((data/np.max(data)*255).astype(np.uint8), lut_8u).
↪astype(float)/255
ax.imshow(np.multiply(np.stack((map[:,:,0],map[:,:,0],map[:,:,0]),axis=2), np.
↪stack((np.full(contrasted_data.
↪shape,1),1-contrasted_data,1-contrasted_data),axis=2)), vmin=0, vmax=1)
# ax.imshow(np.multiply(np.stack((map[:,:,0],map[:,:,0],map[:,:,0]),axis=2),␣
↪np.stack((np.full(data.shape,1),1-data,1-data),axis=2)), vmin=0, vmax=1)
ax.get_xaxis().set_visible(False)
ax.get_yaxis().set_visible(False)
plt.show()

#␣
↪-----------------------------------------------------------------------------
# creating subplot and figure
ax = plt.subplot(111)
data_pred = np.zeros((int(math.ceil(h)),int(math.ceil(w))))

step = int(32/4)
for i in np.arange((w/step+int(div/step-1))*(h/step+int(div/step-1))):
```

```
    c = int(i%(w/step+int(div/step-1))) - int(div/step-1)
    r = int(i/(w/step+int(div/step-1))) - int(div/step-1)
    submap = map[max(step*r,0):step*r+div, max(step*c,0):step*c+div,:]
    subdata = model.predict(np.expand_dims(submap,axis=0),verbose=0)[:,:,:,0]
    subdata = np.squeeze(subdata,axis=0)
    data_pred[max(step*r,0):step*r+div, max(step*c,0):step*c+div] += subdata*1/
↪(int(div/step)*int(div/step))
 contrasted_data = cv2.LUT((data_pred/np.max(data_pred)*255).astype(np.uint8),␣
↪lut_8u).astype(float)/255
 plt.imshow(np.multiply(np.stack((map[:,:,0],map[:,:,0],map[:,:,0]),axis=2),␣
↪np.stack((np.full(contrasted_data.
↪shape,1),1-contrasted_data,1-contrasted_data),axis=2)), vmin=0, vmax=1)
 # plt.imshow(np.multiply(np.stack((map[:,:,0],map[:,:,0],map[:,:,0]),axis=2),␣
↪np.stack((np.full(data_pred.shape,1),1-data_pred,1-data_pred),axis=2)),␣
↪vmin=0, vmax=1)
 ax.get_xaxis().set_visible(False)
 ax.get_yaxis().set_visible(False)
 plt.show()

 data = data/sum(sum(data))
 data_pred = data_pred/sum(sum(data_pred))
 kl = 0
 for i in range(data.shape[0]):
     for j in range(data.shape[1]):
         if data[i,j] > 0 and data_pred[i,j] > 0:
             kl = kl + data[i,j]*math.log2(data[i,j]/data_pred[i,j])
 print(f'KL-divergence: {kl}')
 kl1 = np.append(kl1,kl)

print(f'Mean KL-divergence: {np.mean(kl1)}')
```

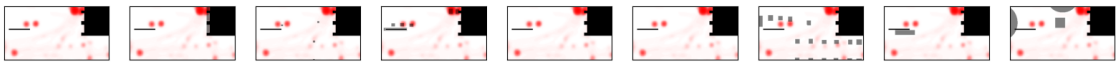
```
stanford_coupa0
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```

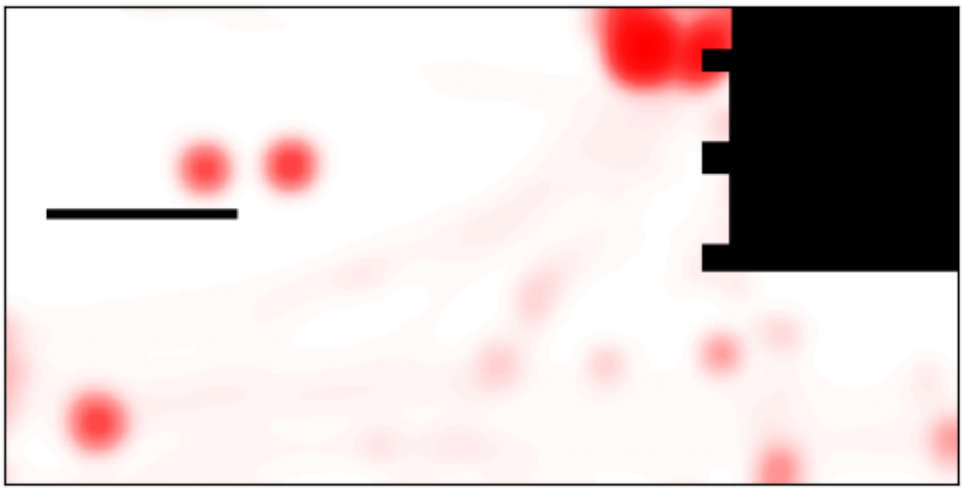


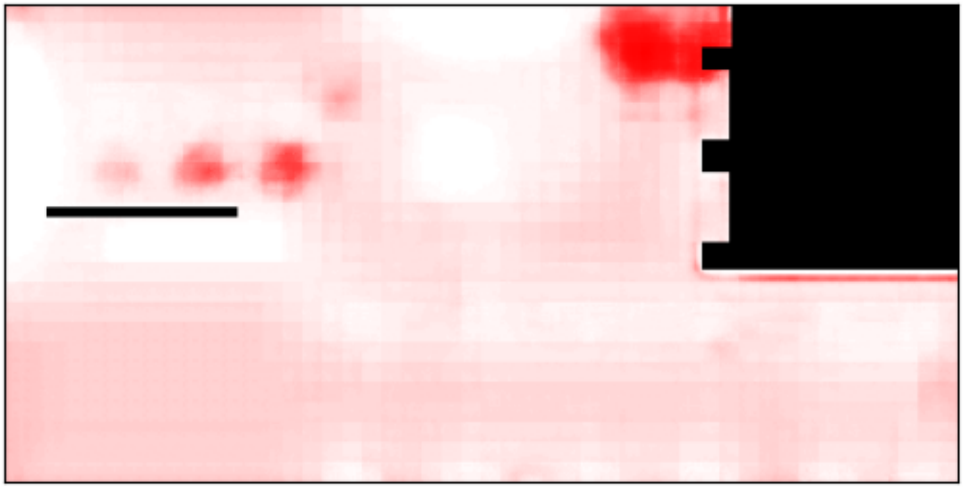




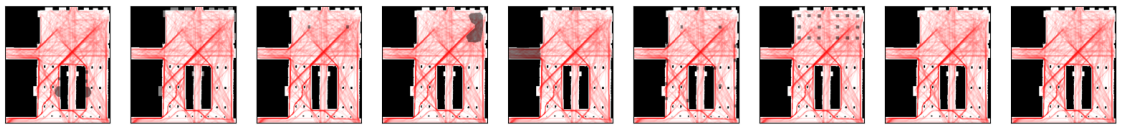
KL-divergence: 1.3071793365963125
stanford_coupa3
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']

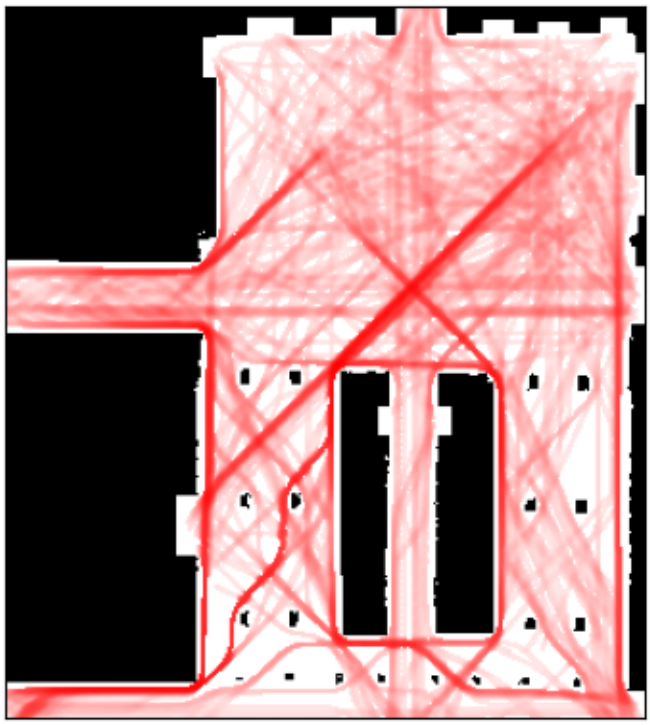


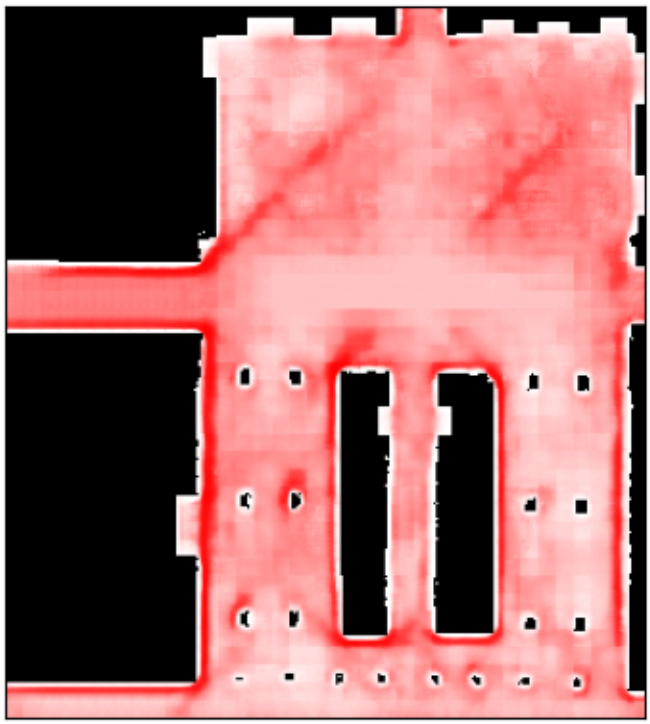




KL-divergence: 0.7772838749013334
master_big
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']

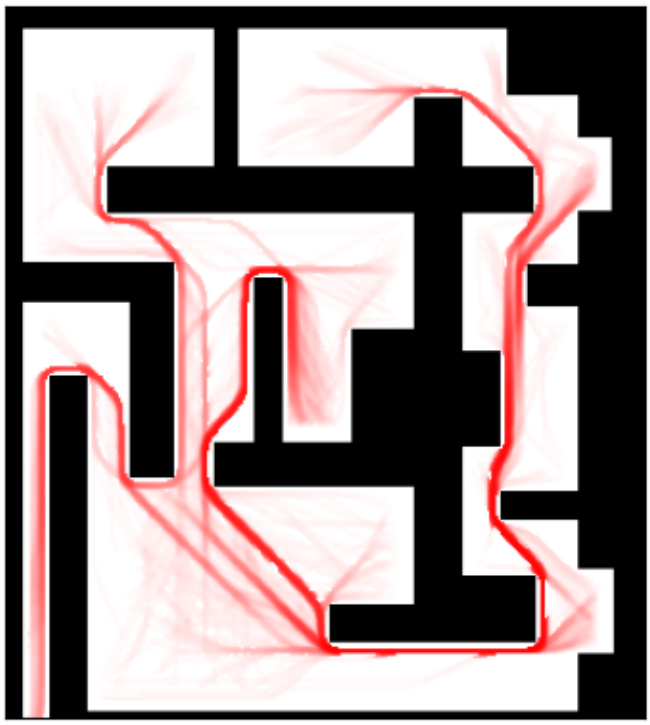




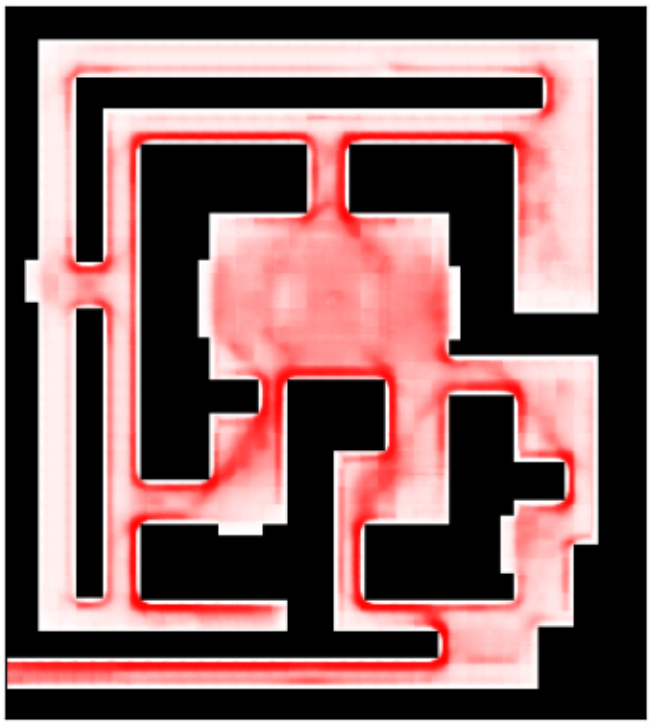


KL-divergence: 0.5224873972247402
willow
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']

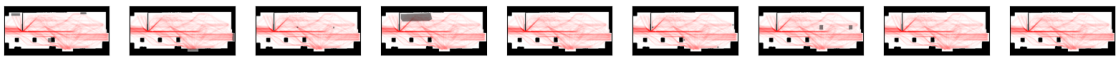
```
KL-divergence: 0.7575344561728802
map1
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```

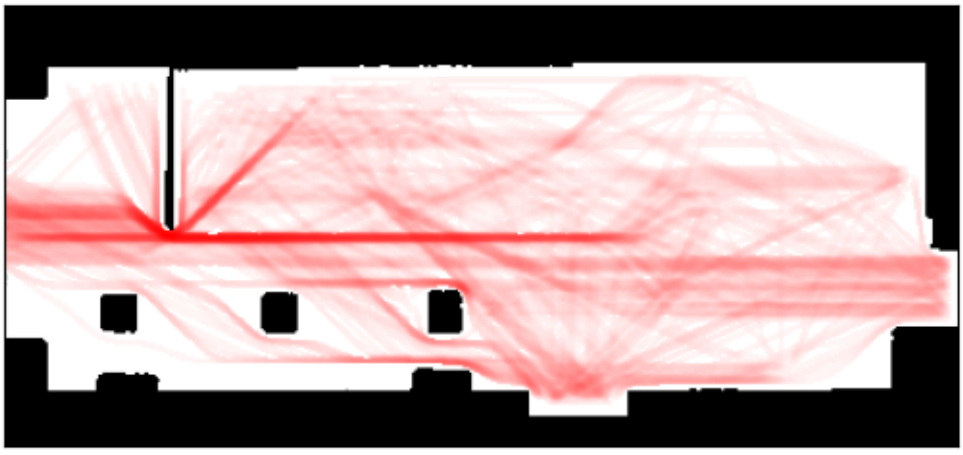


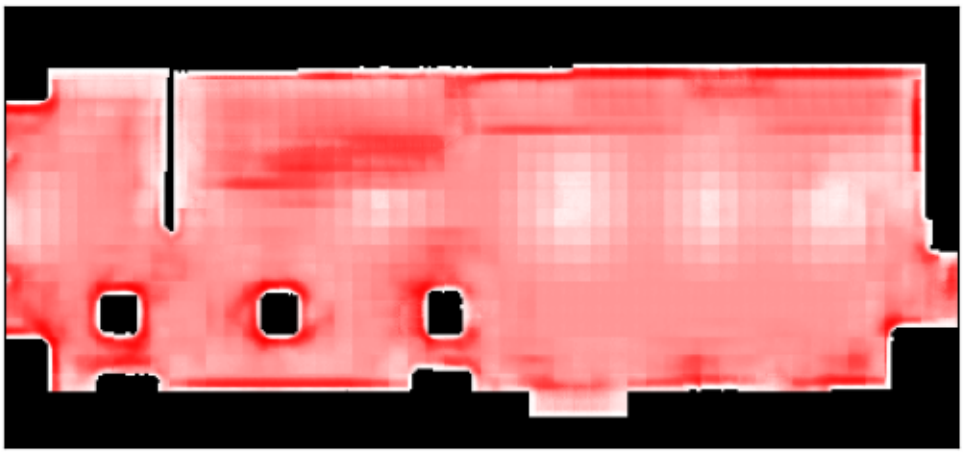
KL-divergence: 0.9122624345420962
map2
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']



KL-divergence: 0.5710570885192234
costacafe
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']







KL-divergence: 1.305392138482892
map3
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']

```
KL-divergence: 1.1167650256351689
Mean KL-divergence: 0.9087452190093308
```

2.3 Model 2 testing

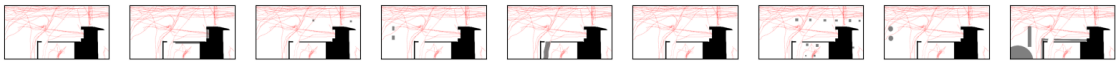
[ ]:
```python
kl1 = []

for map_count, map_name in enumerate(map_list):
  print(map_name)

  lines = 0
  with open('maps/semantics/'+map_name+'/'+map_name+'.csv') as f:
    lines = f.readlines()

  h = len(lines)
  w = len(lines[0].split(','))

  # Converts data to a list of integers
  map = []
  for line in lines:
    map.extend([int(c) for c in line.split(',')])

  for lab_class in sem_dict:
    lines = 0
    try:
      with open('maps/semantics/'+map_name+'/'+map_name+'_sem_'+lab_class+'.
↪csv') as f:
        lines = f.readlines()

      hh = len(lines)
      ww = len(lines[0].split(','))

      if hh != h or ww != w:
        print(f'h: {h}\tw: {w}')
        print(f'h: {hh}\tw: {ww}')
        raise SystemExit("ERROR: Different sizes!!")

      # Converts data to a list of integers
      for line in lines:
        map.extend([int(c) for c in line.split(',')])

    except FileNotFoundError:
      for i in range(h):
        for j in range(w):
          map.extend([255])

  map = np.reshape(map,[chans,h,w])
```

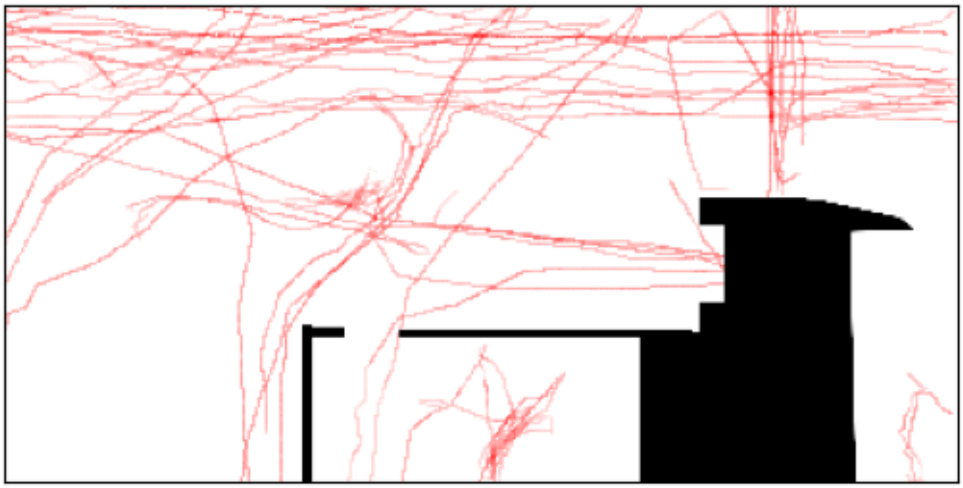
```
  map = np.moveaxis(map, 0, -1)
  map = map/255

  map_aux = map
  map = np.zeros((int(math.ceil(h/red[map_count])),int(math.ceil(w/
↪red[map_count])),chans))

  for idx in range(chans):
    map[:,:,idx] = skimage.measure.block_reduce(map_aux[:,:,idx],␣
↪(red[map_count],red[map_count]), np.max)
  h, w, _ = map.shape

  diff_h = int((h-div*int(h/div))/2)
  r_h = int((h-div*int(h/div))%2) + diff_h
  diff_w = int((w-div*int(w/div))/2)
  r_w = int((w-div*int(w/div))%2) + diff_w
  map = map[r_h:-diff_h:,r_w+diff_w:,:]

  # print(map.shape)
  h, w, _ = map.shape

#␣
↪-------------------------------------------------------------------------------
  lines = 0
  with open('maps/semantics/'+map_name+'/humandensity-'+map_name+'-vel.csv') as␣
↪f:
    lines = f.readlines()

  hd = len(lines)
  wd = len(lines[0].split(','))

  # Converts data to a list of integers
  data = []
  for line in lines:
    data.extend([float(c) for c in line.split(',')])

  data = np.reshape(data,[hd,wd])
  sigma = 2.0
  data = skimage.filters.gaussian(data+(data==0), sigma=(sigma, sigma),␣
↪channel_axis=-1)*(data>0)
  data = skimage.measure.block_reduce(data, (red[map_count],red[map_count]), np.
↪max)
  data = data[r_h:-diff_h,r_w+diff_w:]
  data = np.subtract(data, np.full((h, w), np.min(data)))/(np.max(data)-np.
↪min(data))
```

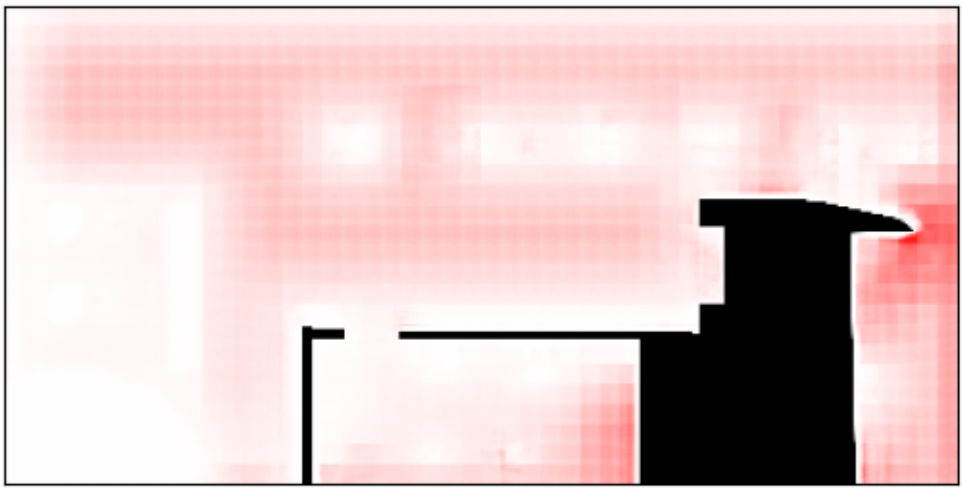
```
# print(data.shape)
hd, wd = data.shape

print(sem_dict)
plt.figure(figsize=(20,5))
for i in range(len(sem_dict)):
  i = i+1
  ax = plt.subplot(1, len(sem_dict), i)
  alp = 0.5
  ax.imshow(np.multiply(np.stack((map[:,:,0],map[:,:,0],map[:,:
↪,0]),axis=2),np.multiply(np.stack((map[:,:,i],map[:,:,i],map[:,:
↪,i]),axis=2)*alp+(1-alp), np.stack((np.full(data.
↪shape,1),1-data,1-data),axis=2))), vmin=0, vmax=1)
  ax.get_xaxis().set_visible(False)
  ax.get_yaxis().set_visible(False)
plt.show()

ax = plt.subplot(111)
ax.imshow(np.multiply(np.stack((map[:,:,0],map[:,:,0],map[:,:,0]),axis=2), np.
↪stack((np.full(data.shape,1),1-data,1-data),axis=2)), vmin=0, vmax=1)
ax.get_xaxis().set_visible(False)
ax.get_yaxis().set_visible(False)
plt.show()

#␣
↪-----------------------------------------------------------------------------
# creating subplot and figure
ax = plt.subplot(111)
data_pred = np.zeros((int(math.ceil(h)),int(math.ceil(w))))

step = int(32/4)
for i in np.arange((w/step+int(div/step-1))*(h/step+int(div/step-1))):
  c = int(i%(w/step+int(div/step-1))) - int(div/step-1)*0
  r = int(i/(w/step+int(div/step-1))) - int(div/step-1)*0
  submap = map[max(step*r,0):step*r+div, max(step*c,0):step*c+div,:]
  subdata = model1.predict(np.expand_dims(submap,axis=0),verbose=0)[:,:,:,0]
  subdata = np.squeeze(subdata,axis=0)
  data_pred[max(step*r,0):step*r+div, max(step*c,0):step*c+div] += subdata*1/
↪(int(div/step)*int(div/step))
plt.imshow(np.multiply(np.stack((map[:,:,0],map[:,:,0],map[:,:,0]),axis=2),␣
↪np.stack((np.full(data_pred.shape,1),1-(data_pred),1-(data_pred)),axis=2)),␣
↪vmin=0, vmax=1)
ax.get_xaxis().set_visible(False)
ax.get_yaxis().set_visible(False)
plt.show()

data = data/sum(sum(data))
```

```
  data_pred = data_pred/sum(sum(data_pred))
  kl = 0
  for i in range(data.shape[0]):
      for j in range(data.shape[1]):
          if data[i,j] > 0 and data_pred[i,j] > 0:
              kl = kl + data[i,j]*math.log2(data[i,j]/data_pred[i,j])
  print(f'KL-divergence: {kl}')
  kl1 = np.append(kl1,kl)

print(f'Mean KL-divergence: {np.mean(kl1)}')
```

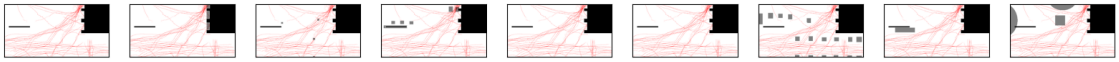
```
stanford_coupa0
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```

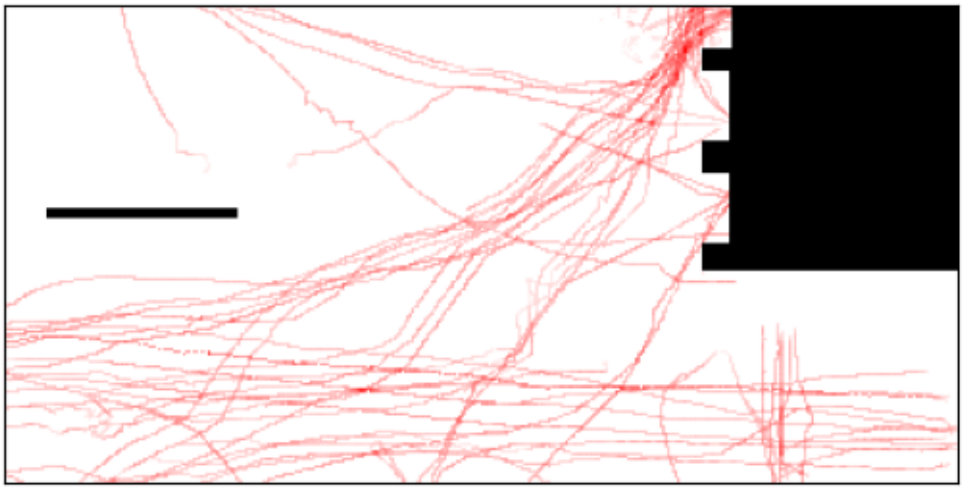


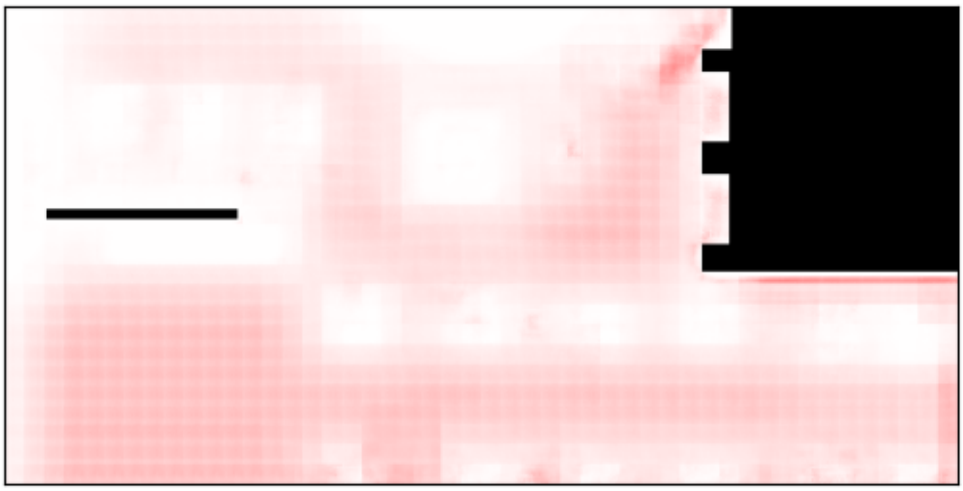




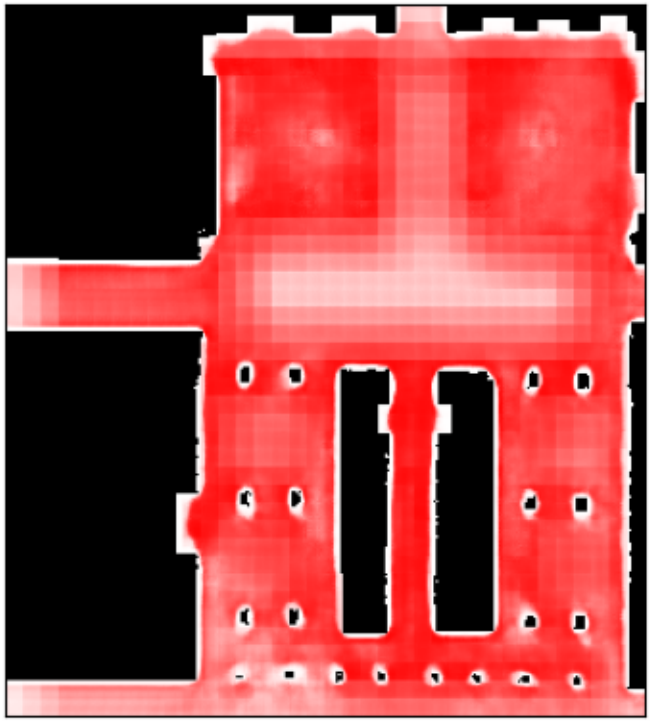
KL-divergence: 2.80160285928463
stanford_coupa3
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']





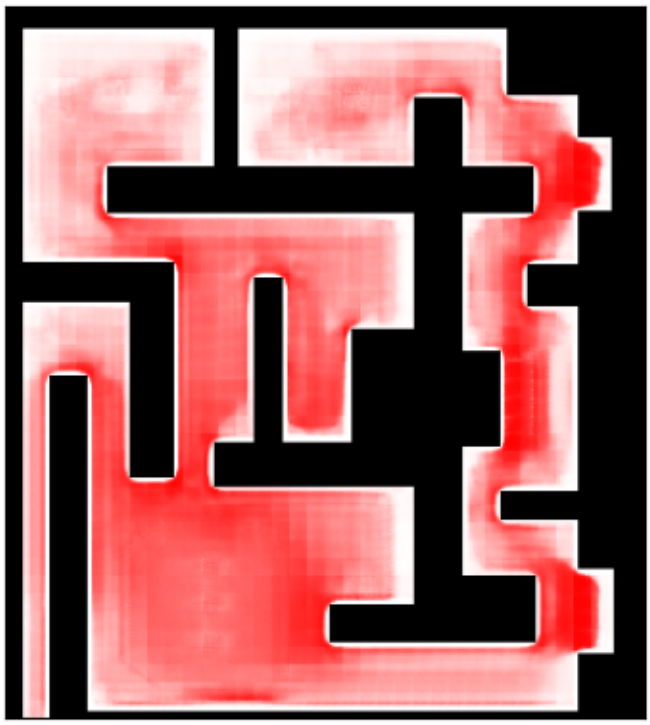


KL-divergence: 2.201714228662227
master_big
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']

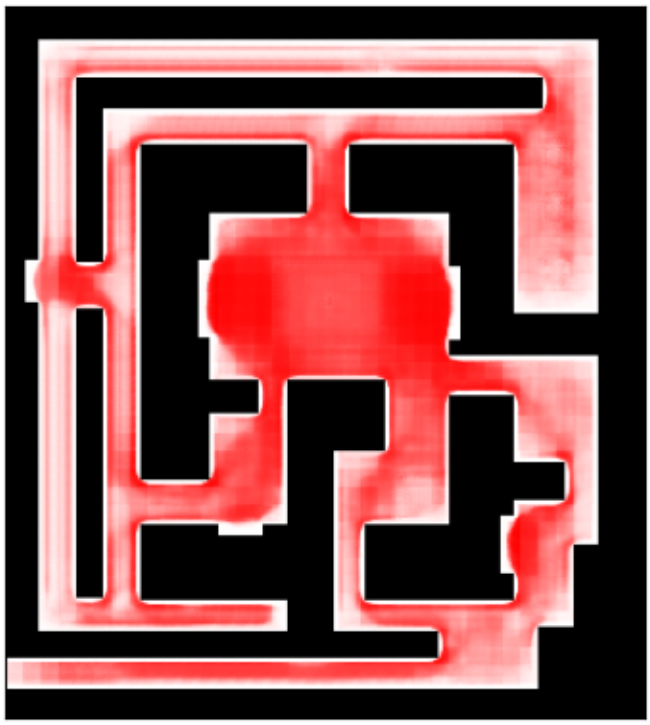


```
KL-divergence: 0.35755279037512444
willow
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```

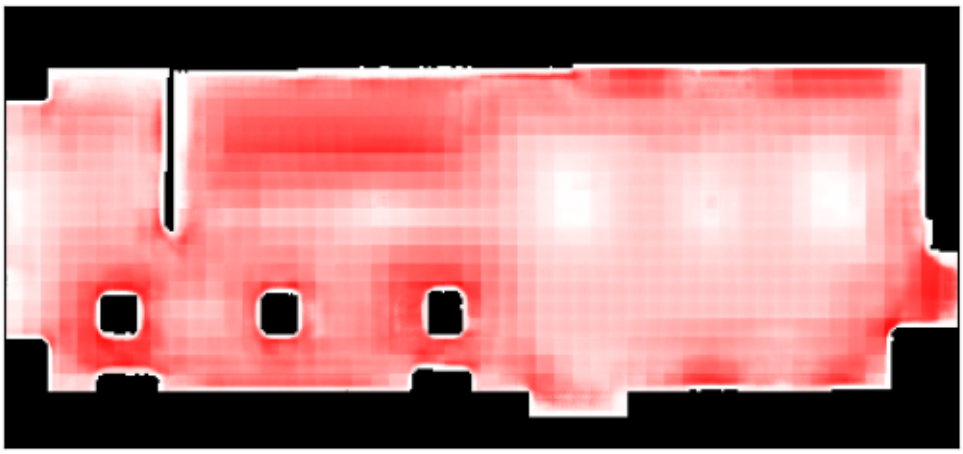
```
KL-divergence: 0.5562784895278279
map1
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```



KL-divergence: 0.6358633742061112
map2
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']



KL-divergence: 0.5095937686366829
costacafe
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']



KL-divergence: 0.7645832143267998
map3
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']

```
KL-divergence: 0.5158539094978517
Mean KL-divergence: 1.042880329314657
```

2.4 Model 3 testing

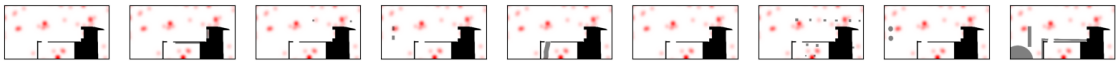
[ ]:
```
kl1 = []

for map_count, map_name in enumerate(map_list):
  print(map_name)

  lines = 0
  with open('maps/semantics/'+map_name+'/'+map_name+'.csv') as f:
    lines = f.readlines()

  h = len(lines)
  w = len(lines[0].split(','))

  # Converts data to a list of integers
  map = []
  for line in lines:
    map.extend([int(c) for c in line.split(',')])

  for lab_class in sem_dict:
    lines = 0
    try:
      with open('maps/semantics/'+map_name+'/'+map_name+'_sem_'+lab_class+'.
↪csv') as f:
        lines = f.readlines()

      hh = len(lines)
      ww = len(lines[0].split(','))

      if hh != h or ww != w:
        print(f'h: {h}\tw: {w}')
        print(f'h: {hh}\tw: {ww}')
        raise SystemExit("ERROR: Different sizes!!")

      # Converts data to a list of integers
      for line in lines:
        map.extend([int(c) for c in line.split(',')])

    except FileNotFoundError:
      for i in range(h):
        for j in range(w):
          map.extend([255])

  map = np.reshape(map,[chans,h,w])
```

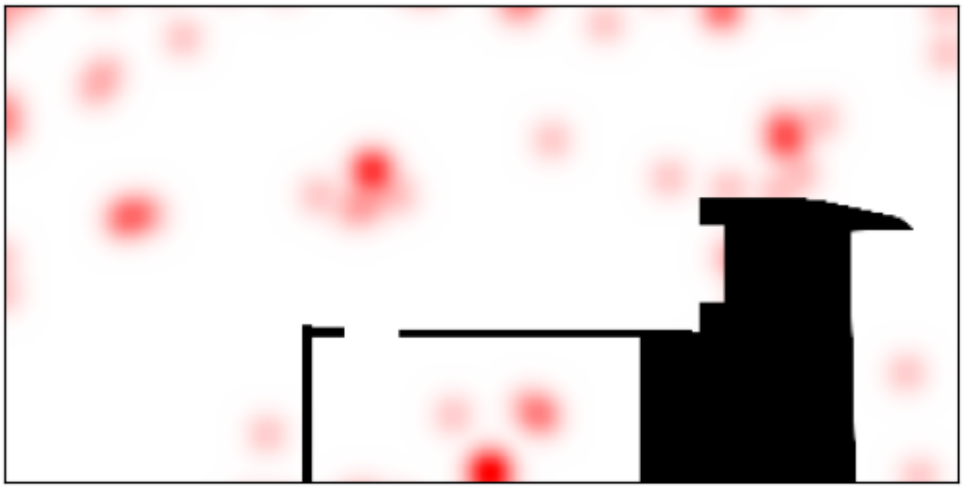
```
  map = np.moveaxis(map, 0, -1)
  map = map/255

  map_aux = map
  map = np.zeros((int(math.ceil(h/red[map_count])),int(math.ceil(w/
 ↪red[map_count])),chans))

  for idx in range(chans):
    map[:,:,idx] = skimage.measure.block_reduce(map_aux[:,:,idx],␣
 ↪(red[map_count],red[map_count]), np.max)
  h, w, _ = map.shape

  diff_h = int((h-div*int(h/div))/2)
  r_h = int((h-div*int(h/div))%2) + diff_h
  diff_w = int((w-div*int(w/div))/2)
  r_w = int((w-div*int(w/div))%2) + diff_w
  map = map[r_h:-diff_h:,r_w+diff_w:,:]

  # print(map.shape)
  h, w, _ = map.shape

#␣
 ↪-------------------------------------------------------------------------------
  lines = 0
  with open('maps/semantics/'+map_name+'/humandensity-'+map_name+'-stop.csv')␣
 ↪as f:
    lines = f.readlines()

  hd = len(lines)
  wd = len(lines[0].split(','))

  # Converts data to a list of integers
  data = []
  for line in lines:
    data.extend([float(c) for c in line.split(',')])

  data = np.reshape(data,[hd,wd])
  sigma = 4.0
  data = skimage.filters.gaussian(data, sigma=(sigma, sigma), channel_axis=-1)
  data = skimage.measure.block_reduce(data, (red[map_count],red[map_count]), np.
 ↪max)
  data = data[r_h:-diff_h,r_w+diff_w:]
  data = np.subtract(data, np.full((h, w), np.min(data)))/(np.max(data)-np.
 ↪min(data))

  # print(data.shape)
```

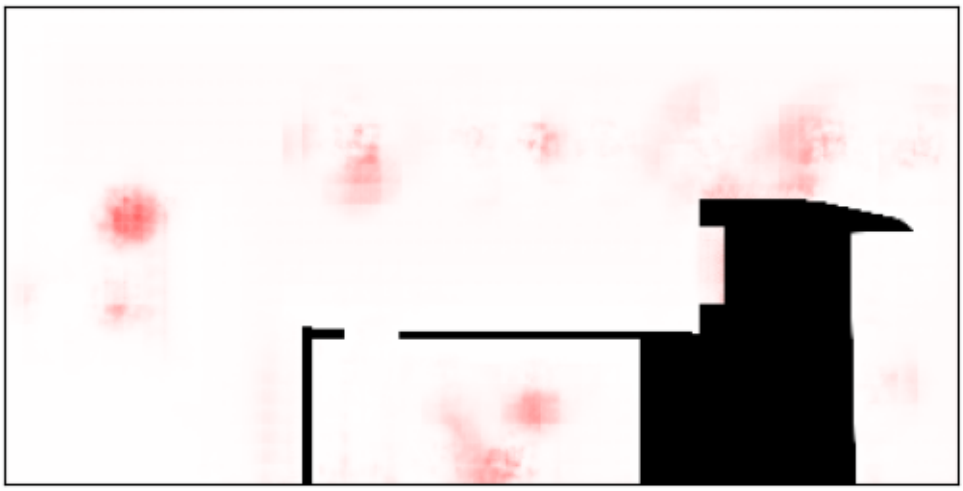
```
hd, wd = data.shape

print(sem_dict)
plt.figure(figsize=(20,5))
for i in range(len(sem_dict)):
  i = i+1
  ax = plt.subplot(1, len(sem_dict), i)
  alp = 0.5
  ax.imshow(np.multiply(np.stack((map[:,:,0],map[:,:,0],map[:,:
↪,0]),axis=2),np.multiply(np.stack((map[:,:,i],map[:,:,i],map[:,:
↪,i]),axis=2)*alp+(1-alp), np.stack((np.full(data.
↪shape,1),1-data,1-data),axis=2))), vmin=0, vmax=1)
  ax.get_xaxis().set_visible(False)
  ax.get_yaxis().set_visible(False)
plt.show()

ax = plt.subplot(111)
ax.imshow(np.multiply(np.stack((map[:,:,0],map[:,:,0],map[:,:,0]),axis=2), np.
↪stack((np.full(data.shape,1),1-data,1-data),axis=2)), vmin=0, vmax=1)
ax.get_xaxis().set_visible(False)
ax.get_yaxis().set_visible(False)
plt.show()

#␣
↪-------------------------------------------------------------------------------
# creating subplot and figure
ax = plt.subplot(111)
data_pred = np.zeros((int(math.ceil(h)),int(math.ceil(w))))

step = int(32/4)
for i in np.arange((w/step+int(div/step-1))*(h/step+int(div/step-1))):
  c = int(i%(w/step+int(div/step-1))) - int(div/step-1)*0
  r = int(i/(w/step+int(div/step-1))) - int(div/step-1)*0
  submap = map[max(step*r,0):step*r+div, max(step*c,0):step*c+div,:]
  subdata = model2.predict(np.expand_dims(submap,axis=0),verbose=0)[:,:,:,0]
  subdata = np.squeeze(subdata,axis=0)
  data_pred[max(step*r,0):step*r+div, max(step*c,0):step*c+div] += subdata*1/
↪(int(div/step)*int(div/step))
plt.imshow(np.multiply(np.stack((map[:,:,0],map[:,:,0],map[:,:,0]),axis=2),␣
↪np.stack((np.full(data_pred.shape,1),1-(data_pred),1-(data_pred)),axis=2)),␣
↪vmin=0, vmax=1)
ax.get_xaxis().set_visible(False)
ax.get_yaxis().set_visible(False)
plt.show()

data = data/sum(sum(data))
data_pred = data_pred/sum(sum(data_pred))
```

```
  kl = 0
  for i in range(data.shape[0]):
      for j in range(data.shape[1]):
          if data[i,j] > 0 and data_pred[i,j] > 0:
              kl = kl + data[i,j]*math.log2(data[i,j]/data_pred[i,j])
  print(f'KL-divergence: {kl}')
  kl1 = np.append(kl1,kl)


print(f'Mean KL-divergence: {np.mean(kl1)}')
```

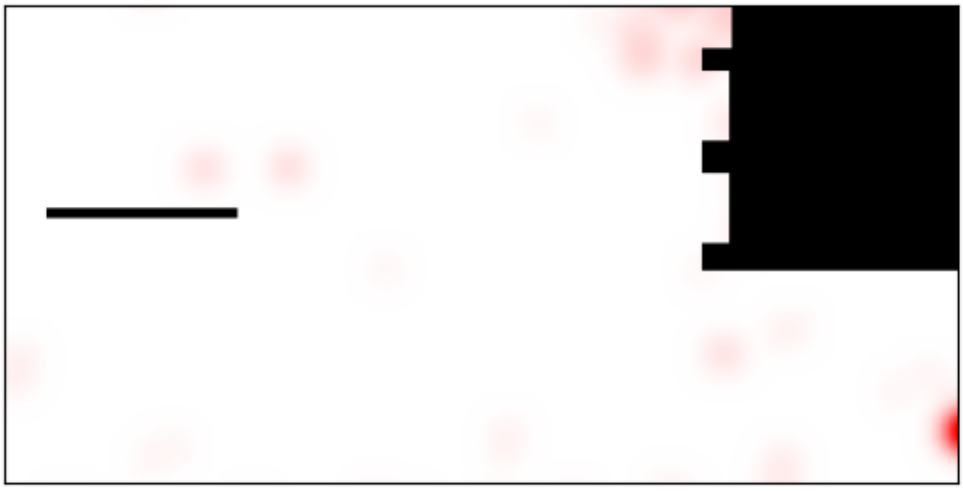
```
stanford_coupa0
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```



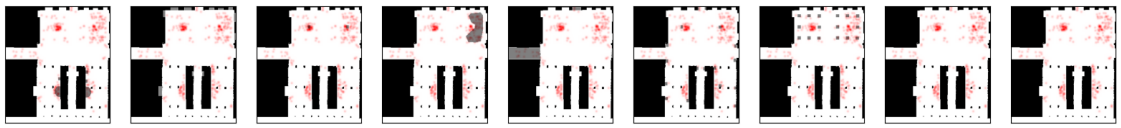




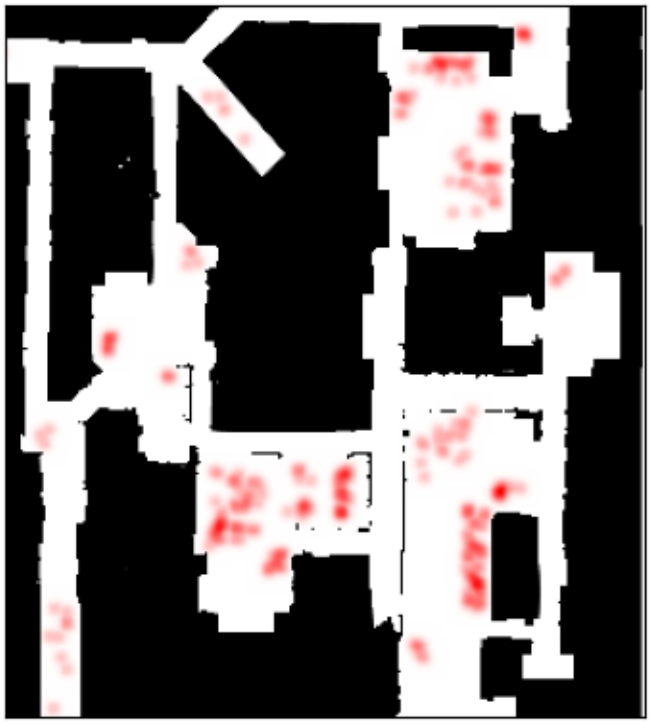
KL-divergence: 1.4247813910642708
stanford_coupa3
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']



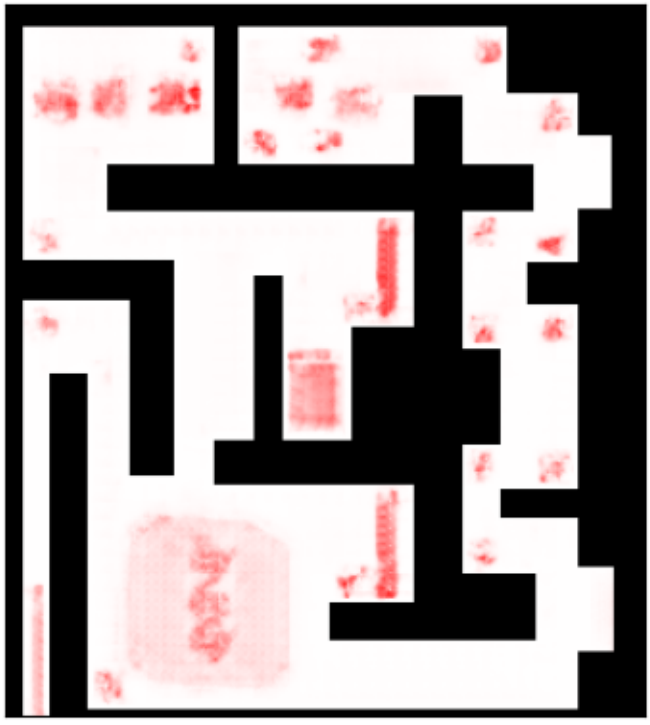
KL-divergence: 2.6467282603169733
master_big
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']



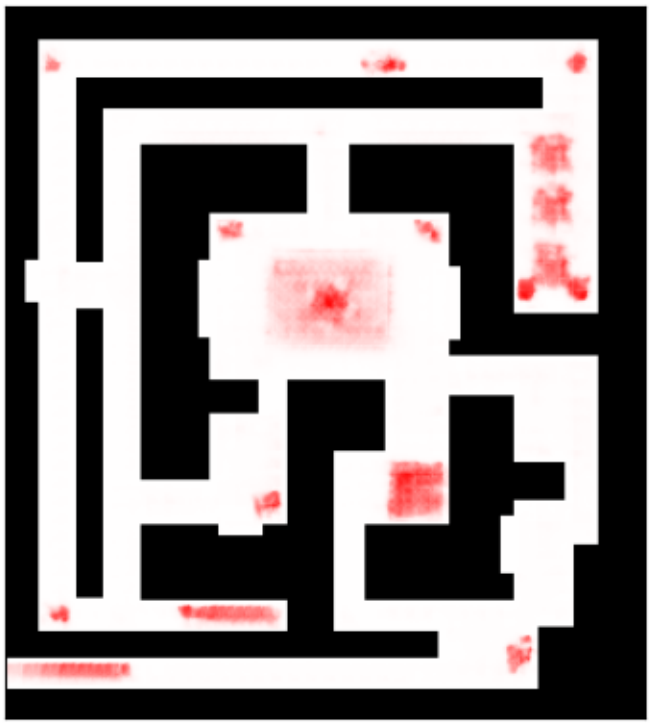
KL-divergence: 1.33254127753417
willow
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']



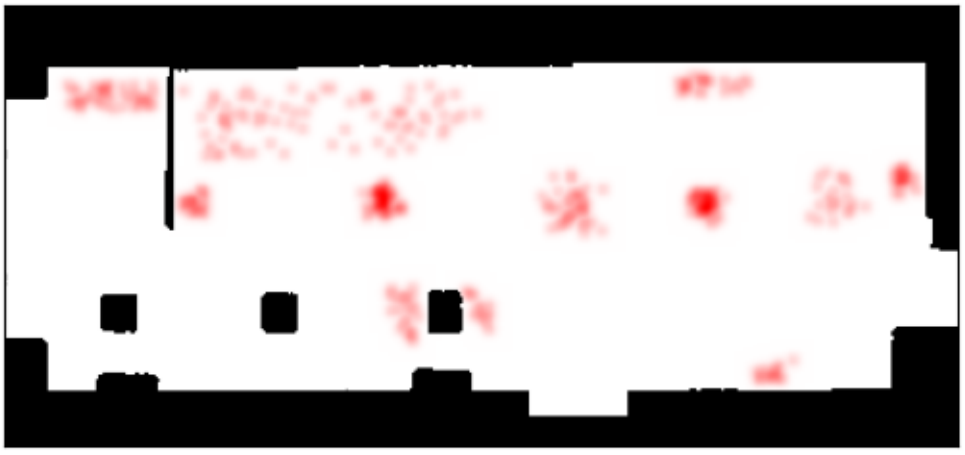
```
KL-divergence: 1.070808225387258
map1
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```



KL-divergence: 1.1021081641039343
map2
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']



KL-divergence: 0.7919932450900737
costacafe
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']



KL-divergence: 2.089103484661316
map3
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']

```
KL-divergence: 1.6990811398580883
Mean KL-divergence: 1.5196431485020105
```