models_validation_sim_20_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/19set_8px_steps_sim_paths')

model1 = tf.keras.models.load_model('IRI_models/19set_8px_steps_sim_vels')

model2 = tf.keras.models.load_model('IRI_models/19set_8px_steps_sim_stops')
```

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)
```

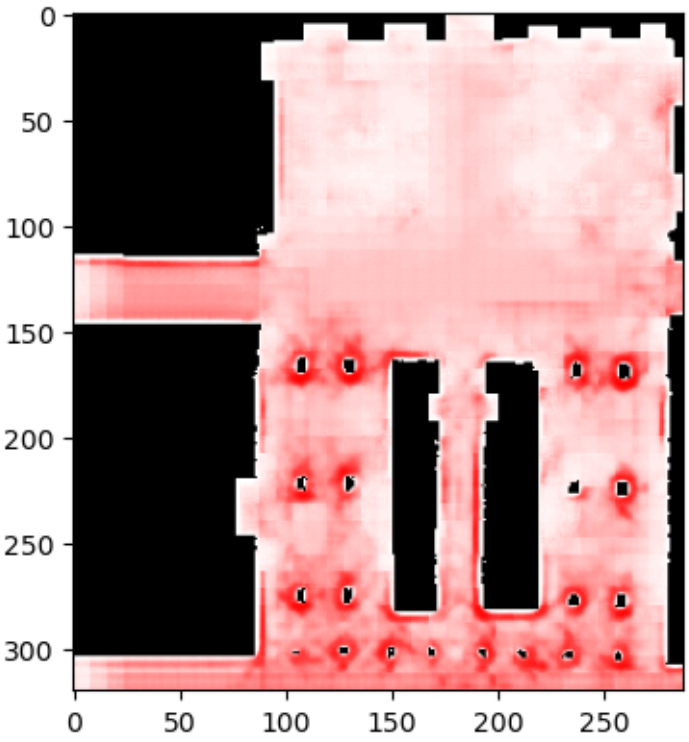
2.1 Testing closed corridors (completely or partially closed)

[ ]:
```
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!!")
```

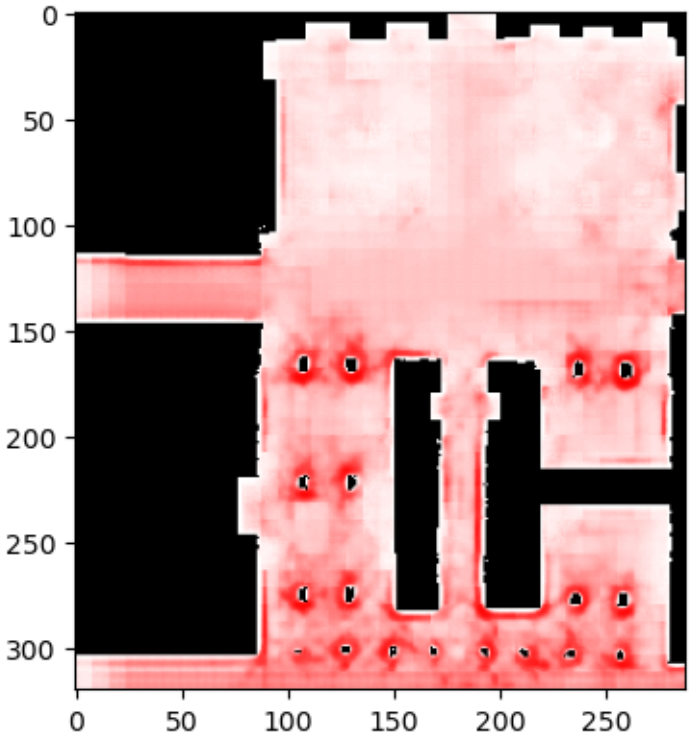
```
    # Converts data to a list of integers
    for line in lines:
      map.extend([int(c) for c in line.split(',')])

  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()
```

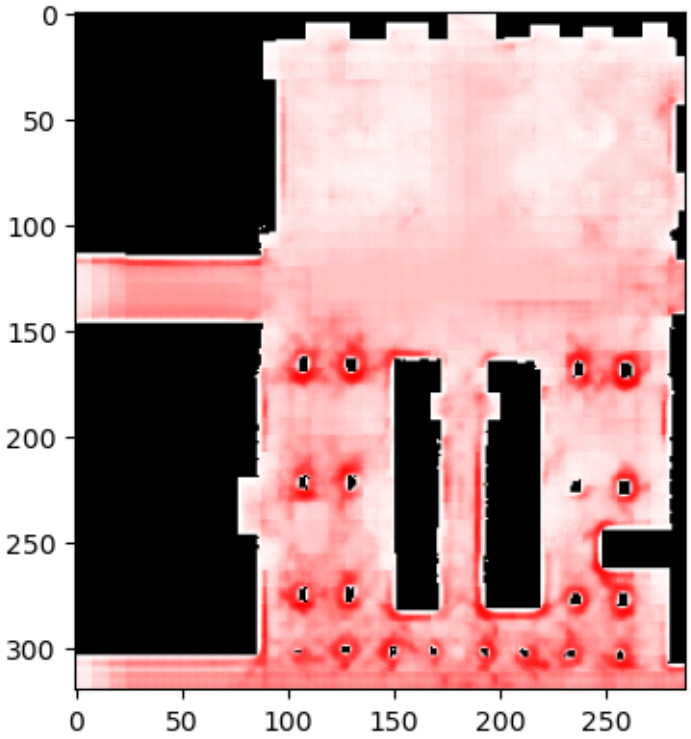
master_big



master_big_closed



master_big_semiclosed



2.2 Model 1 testing

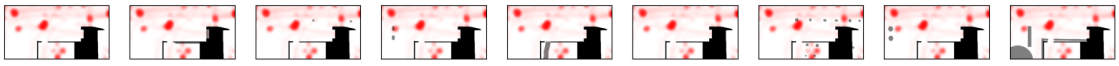
[ ]:
```
map_list = ['stanford_coupa0',␣
 ↪'stanford_coupa3','master_big','willow','map1','map2','costacafe','map3']
kl1 = []

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])
```

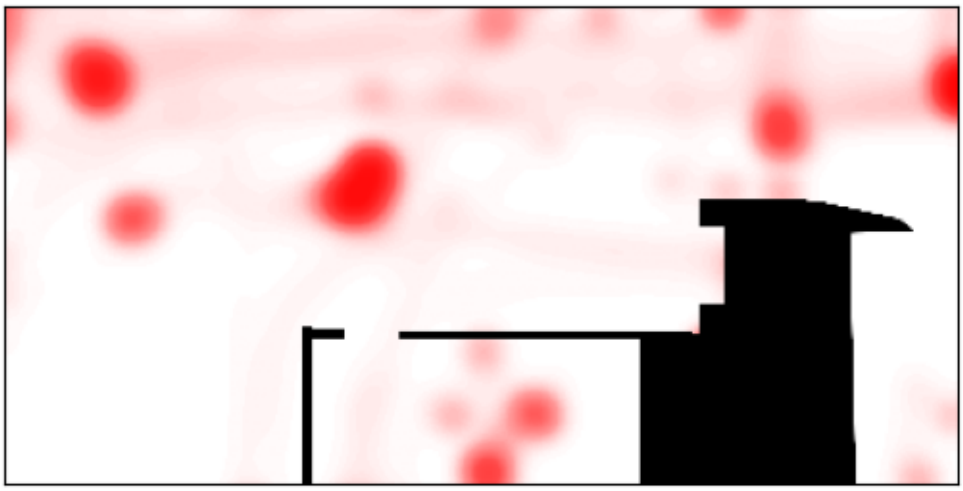
```
  map = np.reshape(map,[chans,h,w])
  map = np.moveaxis(map, 0, -1)
  map = map/255

  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:]
```

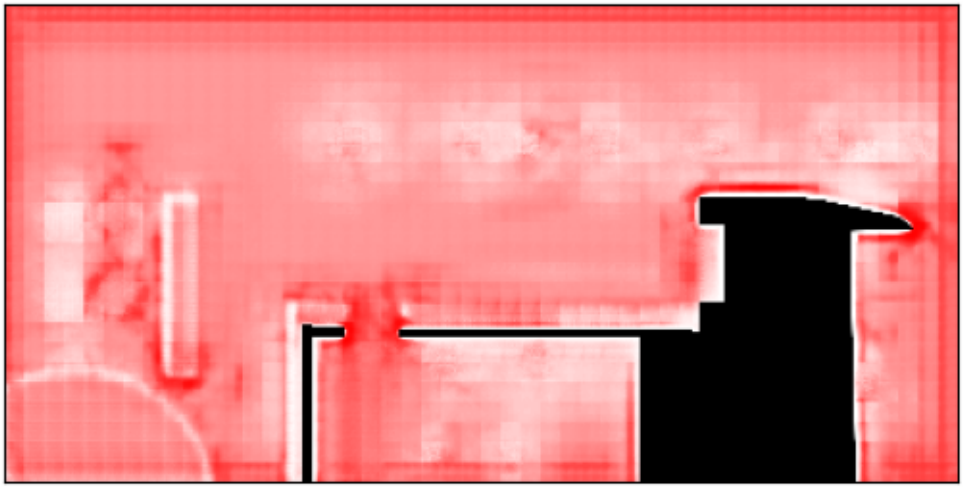
```
data = np.subtract(data, np.full((h, w), np.min(data)))/(np.max(data)-np.
↪min(data))

# 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)}')
```

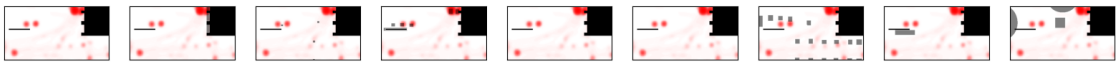
```
stanford_coupa0
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```

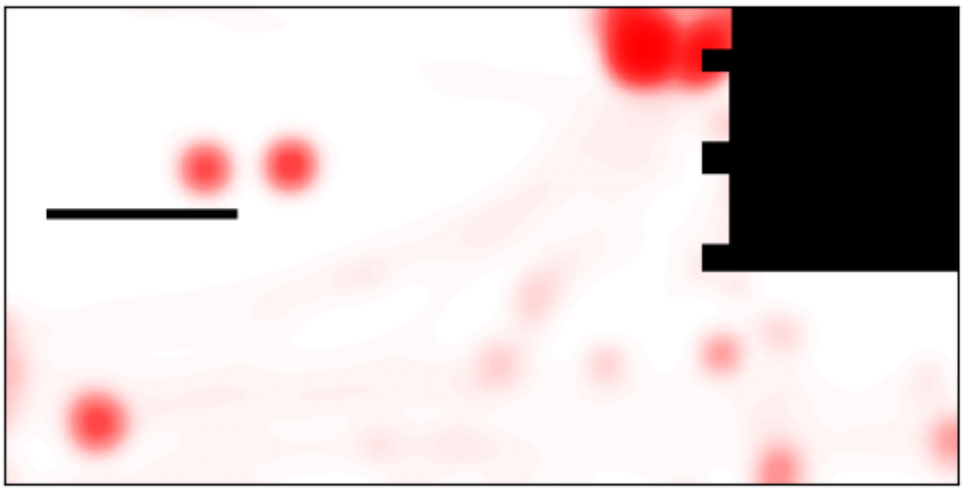


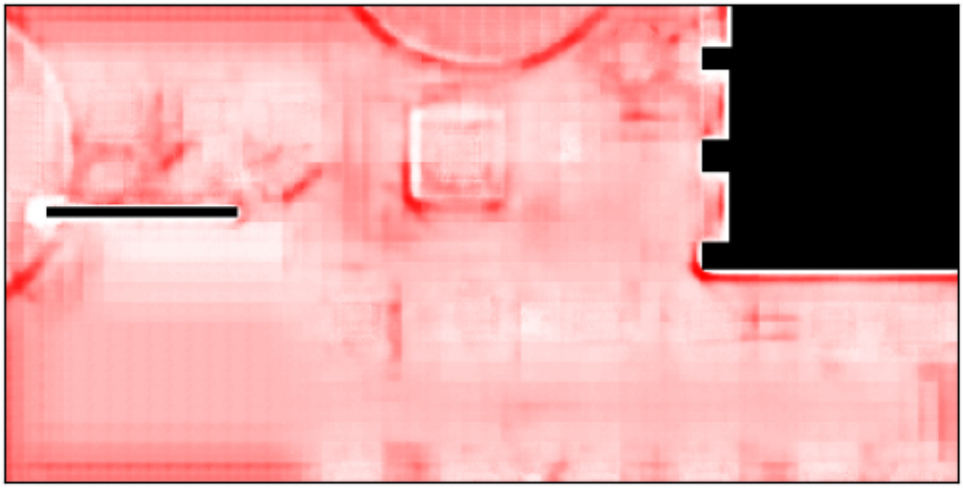




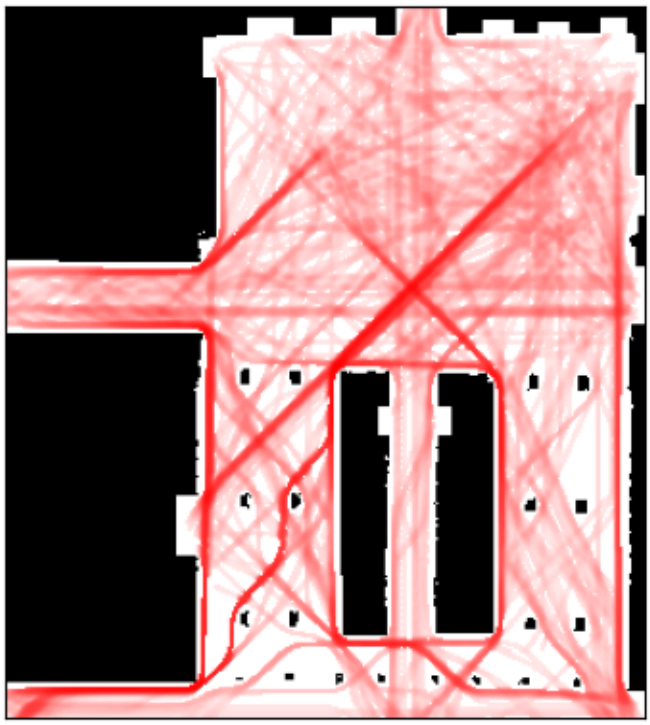
KL-divergence: 4.518112195860794
stanford_coupa3
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']

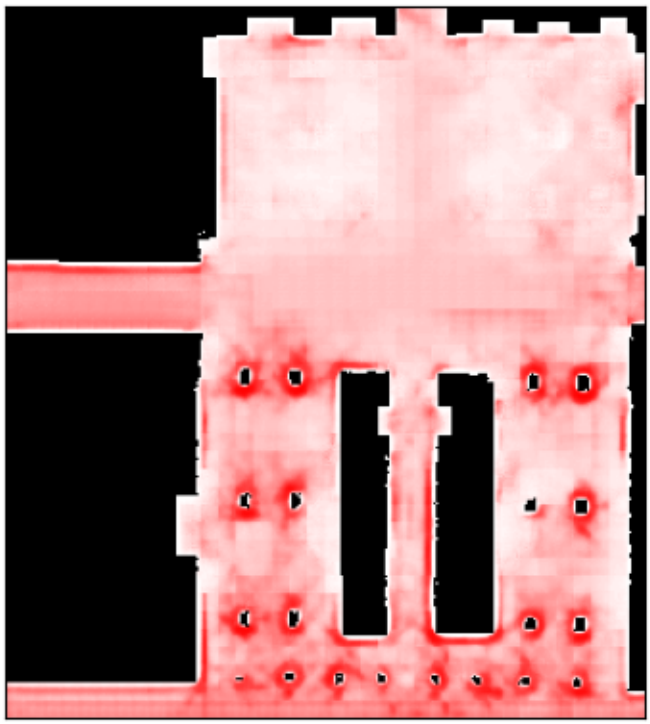






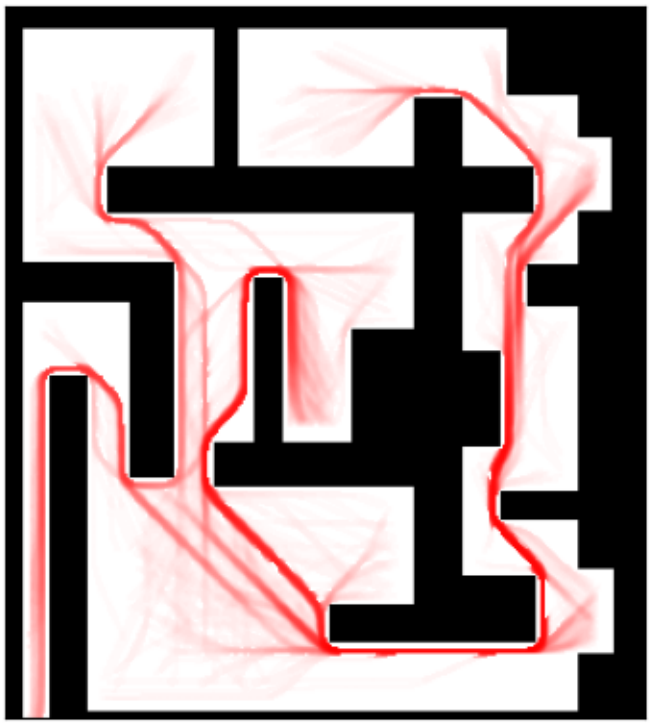
KL-divergence: 3.8717913302326665
master_big
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']

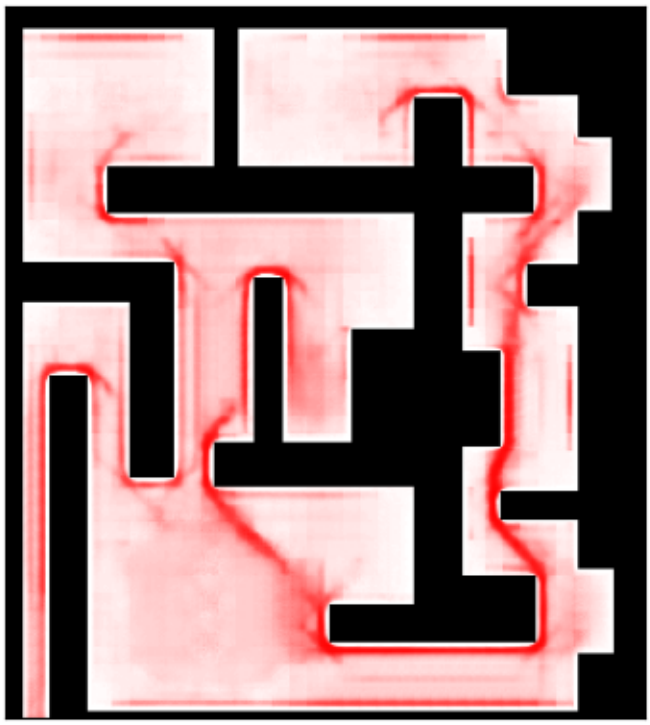




```
KL-divergence: 1.1829334133241758
willow
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```

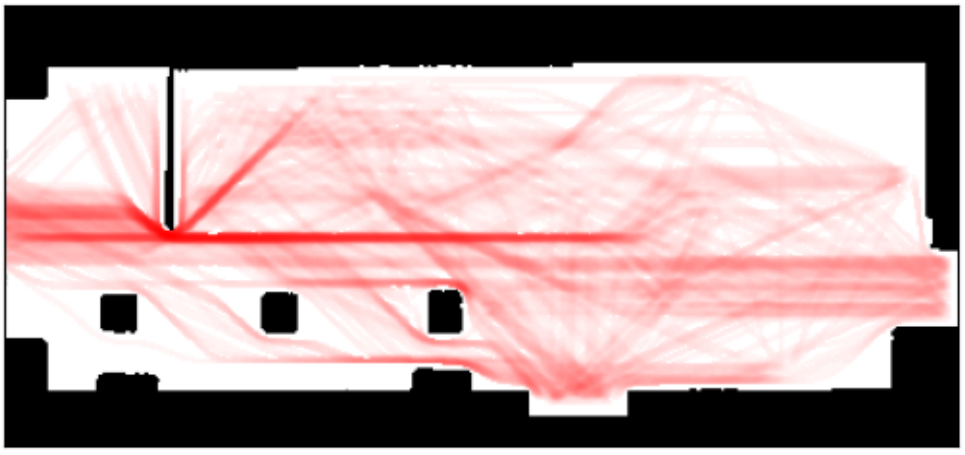
```
KL-divergence: 1.8868753810840453
map1
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```





KL-divergence: 0.7738006218152124
map2
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']

KL-divergence: 0.48070392095342834
costacafe
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']



KL-divergence: 0.5429739232755503
map3
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']

```
KL-divergence: 0.4410120235553463
Mean KL-divergence: 1.7122753512626523
```

2.3 Model 2 testing

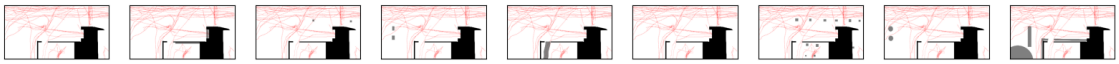
[ ]:
```
kl1 = []

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])
```

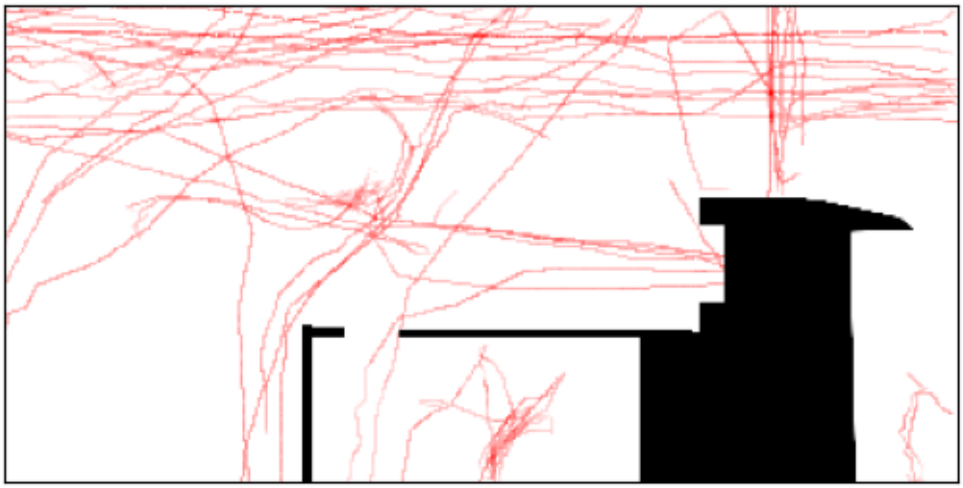
```
  map = np.moveaxis(map, 0, -1)
  map = map/255

  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+'-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))
```

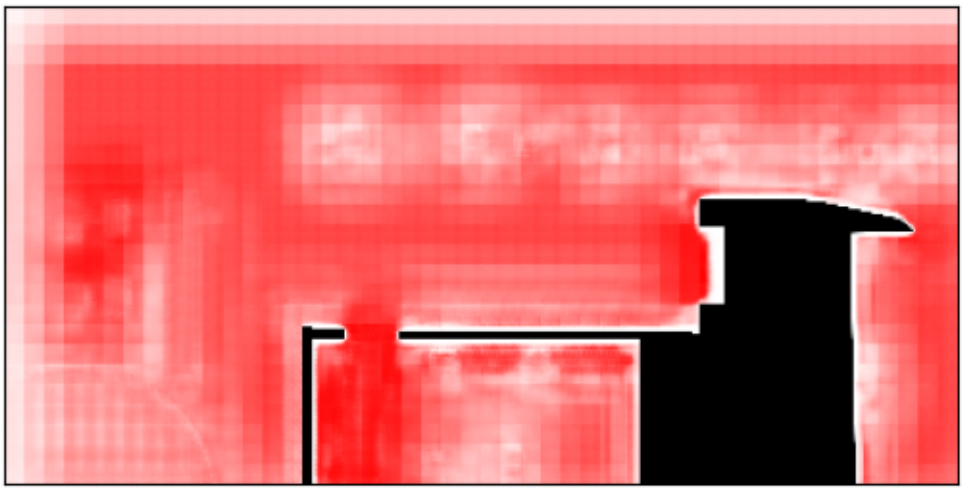
```
# print(data.shape)
hd, wd = data.shape

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)}')
```

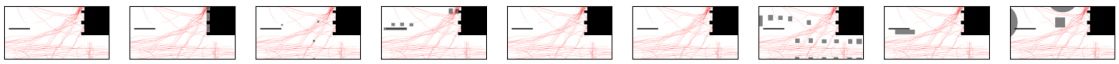
```
stanford_coupa0
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```

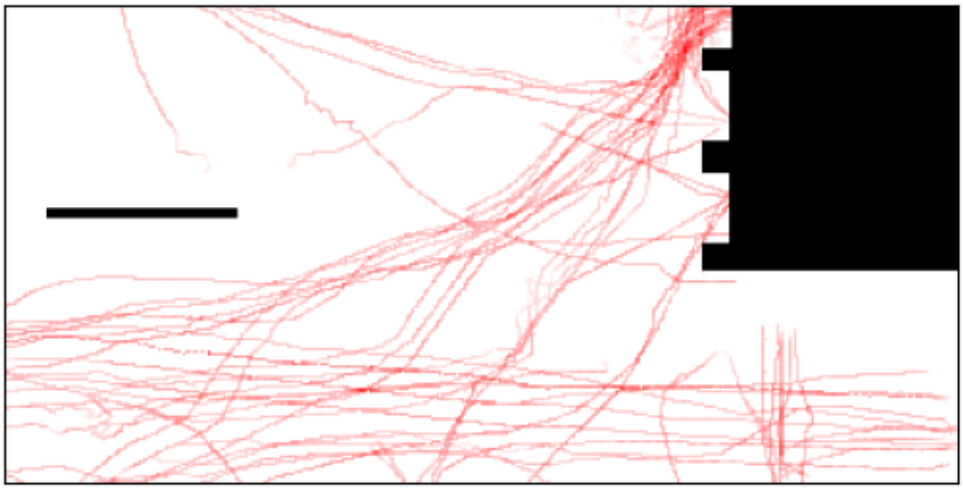


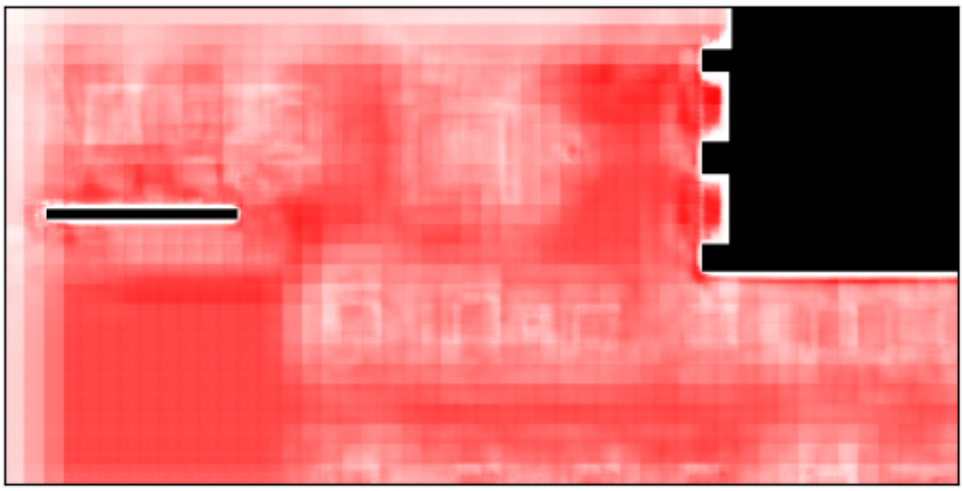




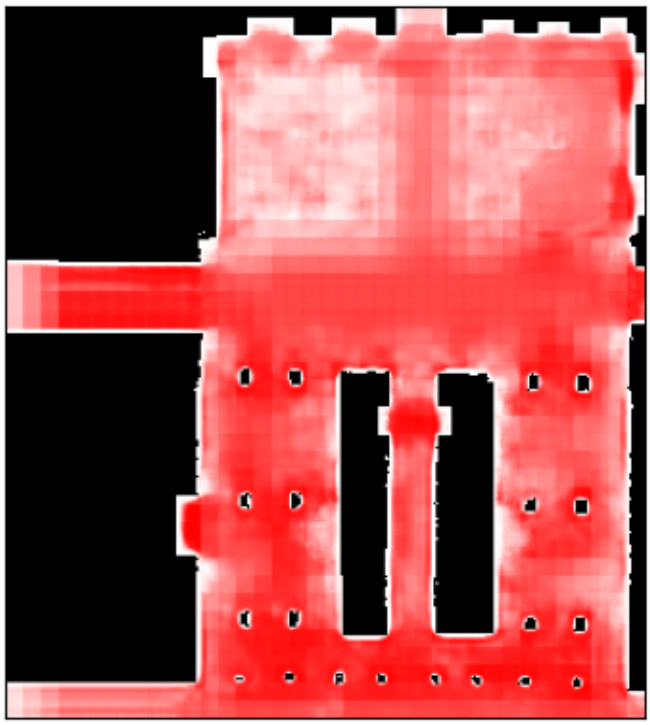
KL-divergence: 3.287900715414532
stanford_coupa3
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']





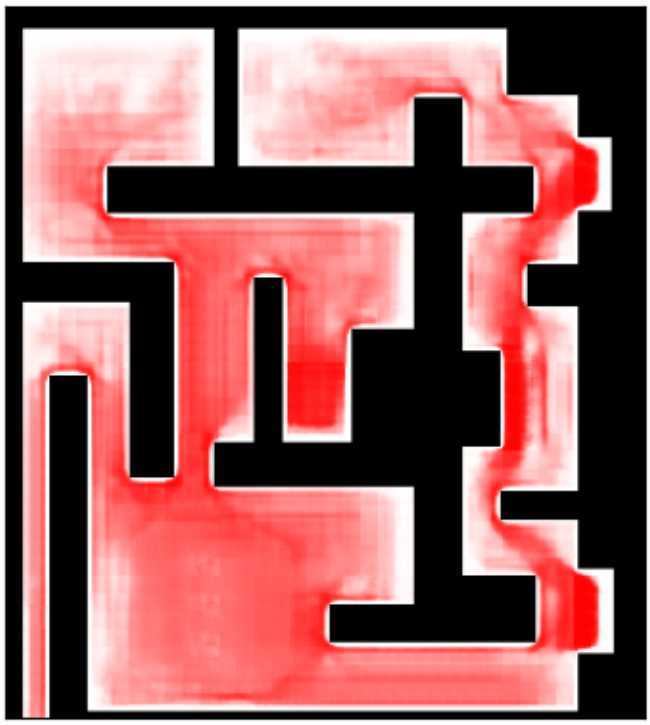


```
KL-divergence: 2.8207685275511327
master_big
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```



```
KL-divergence: 0.4621462375282013
willow
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```

```
KL-divergence: 1.0690773920923857
map1
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```



```
KL-divergence: 0.5741153406665332
map2
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```

KL-divergence: 0.4225428096907106
costacafe
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']

KL-divergence: 0.273294065057896
map3
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']

```
KL-divergence: 0.2725712214652937
Mean KL-divergence: 1.1478020386833356
```

2.4 Model 3 testing

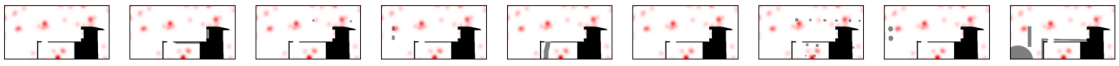
[ ]:
```
kl1 = []

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])
```

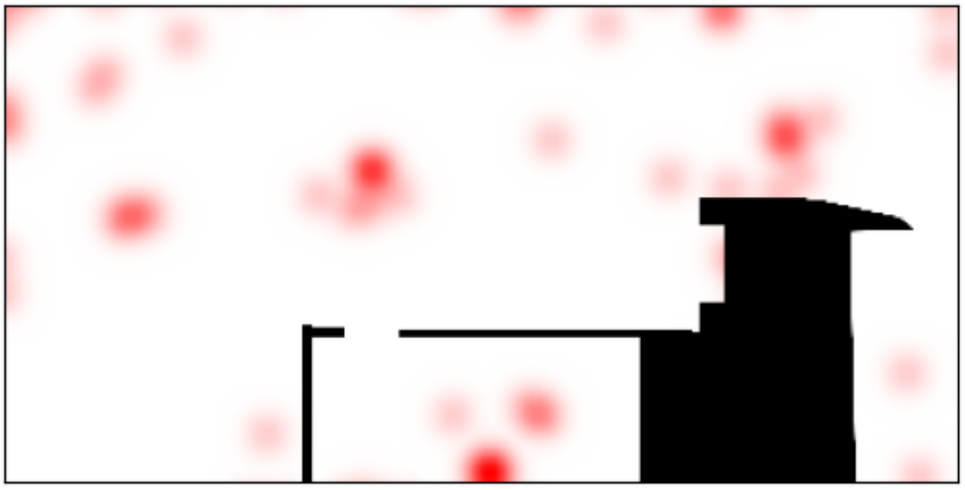
```
  map = np.moveaxis(map, 0, -1)
  map = map/255

  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)
```

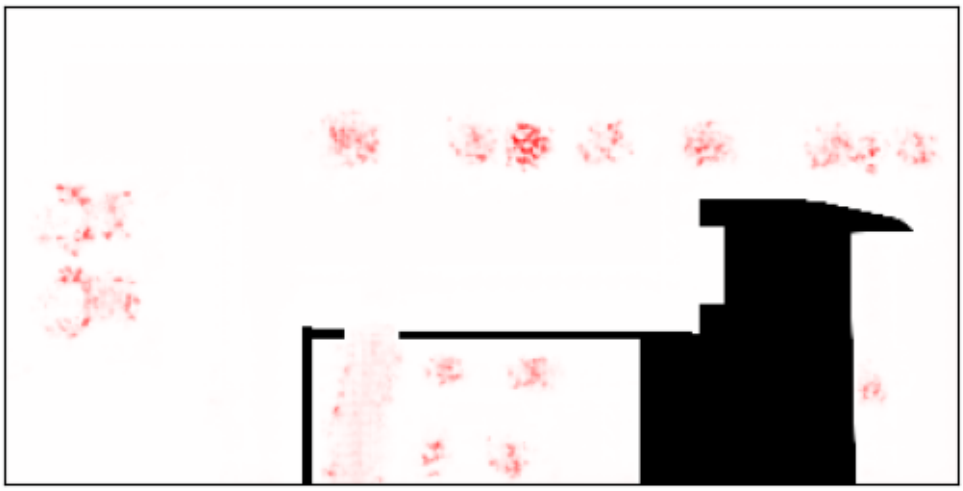
```
hd, wd = data.shape

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)}')
```

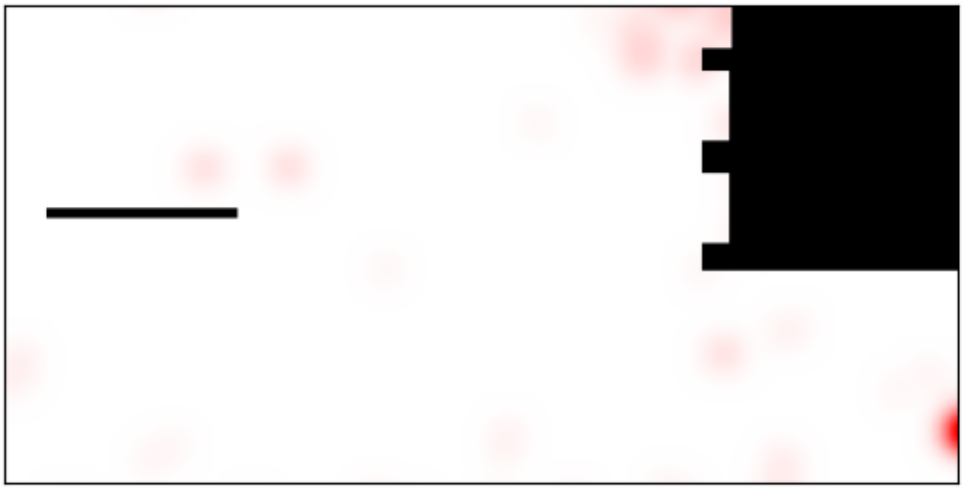
```
stanford_coupa0
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```

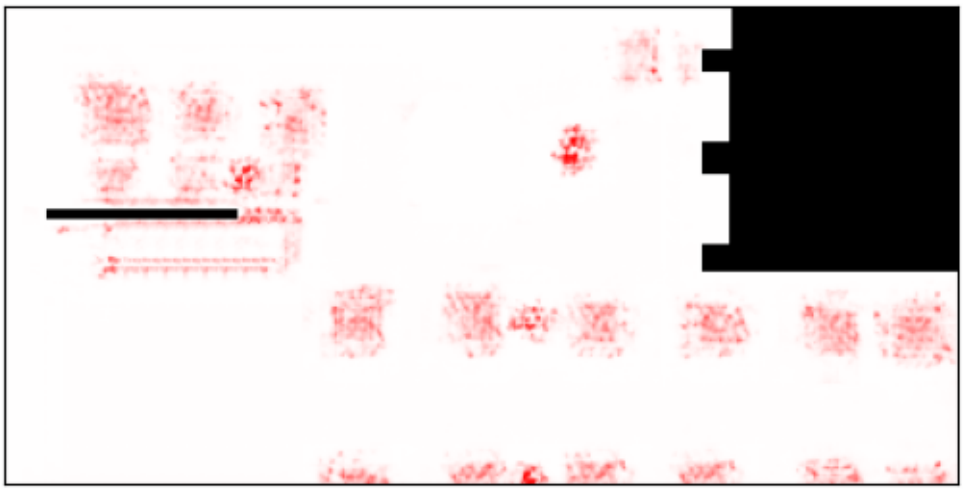




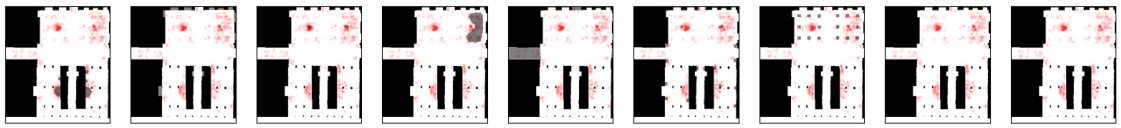


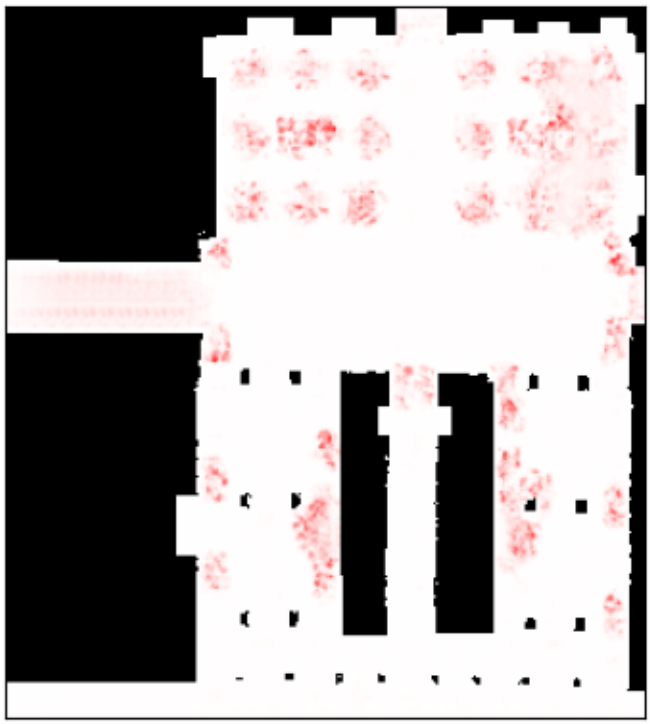
KL-divergence: 5.469336971750047
stanford_coupa3
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']



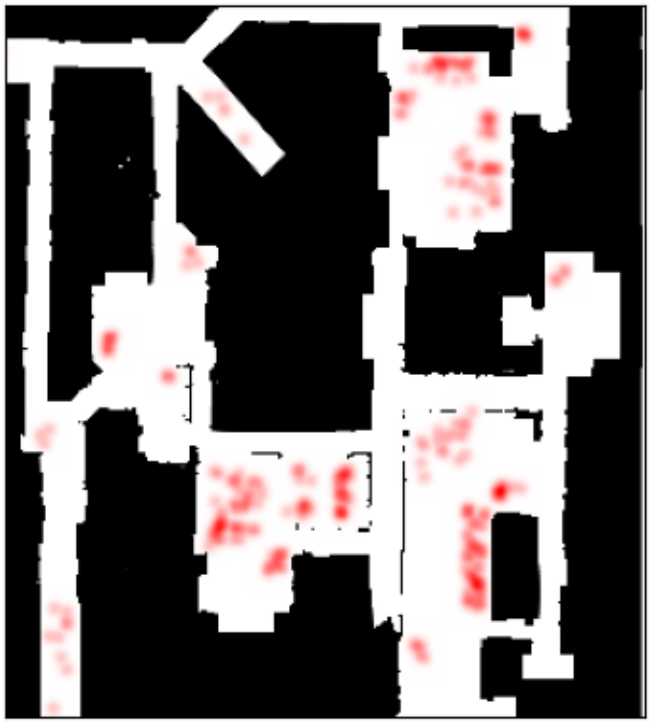


KL-divergence: 7.867544808335382
master_big
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']

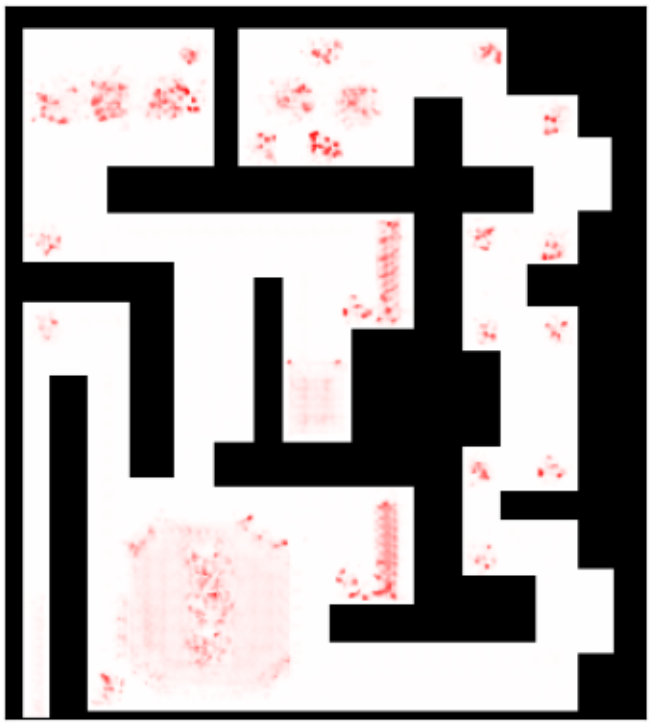




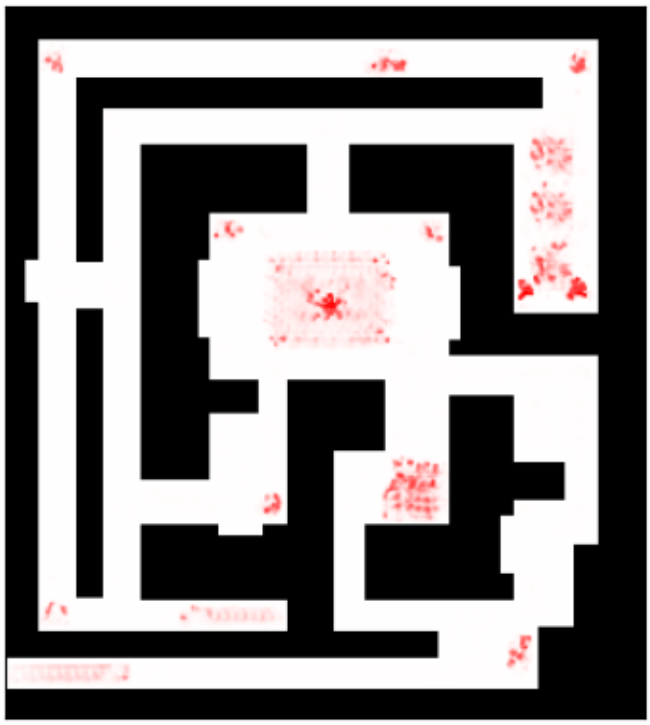
KL-divergence: 1.9453598306898021
willow
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']



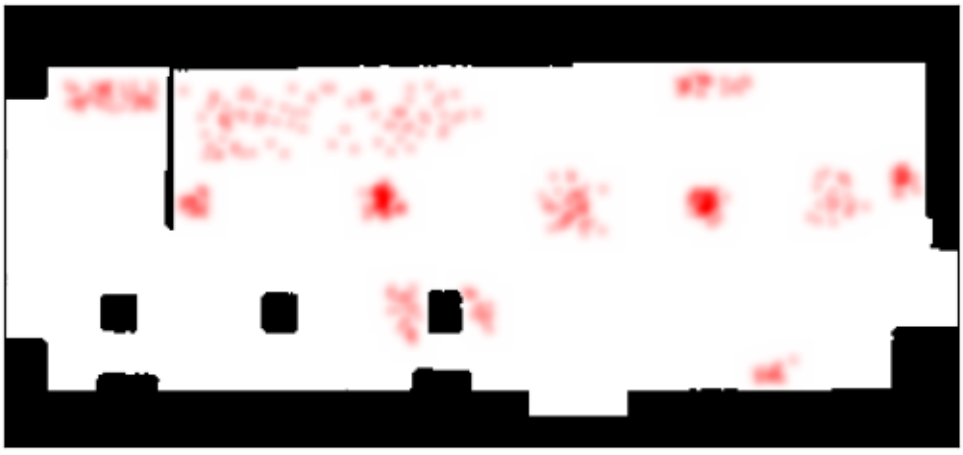
```
KL-divergence: 1.824355363375735
map1
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```



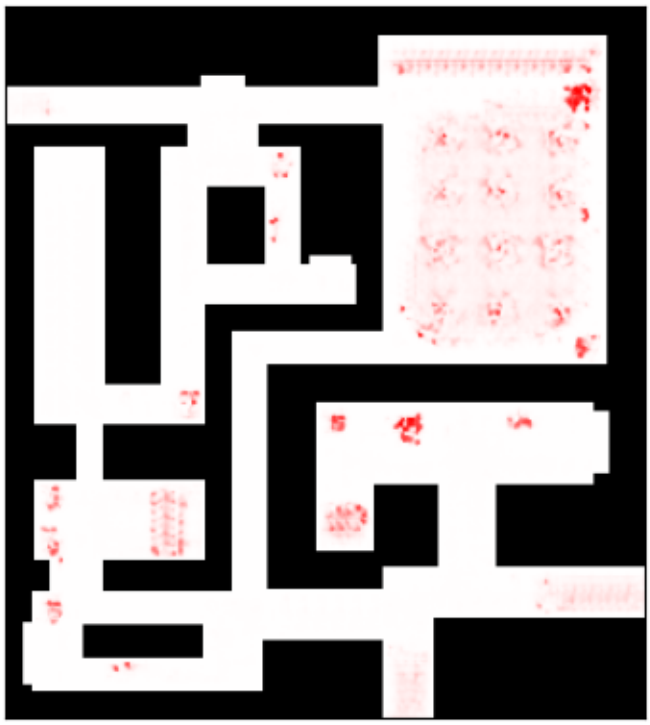
KL-divergence: 0.9248461967199777
map2
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']



KL-divergence: 0.839195422393642
costacafe
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']



KL-divergence: 0.8500190990583372
map3
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted', 'grass']



```
KL-divergence: 0.9538760466407823
Mean KL-divergence: 2.5843167173704633
```