models_validation_mix_26_set

September 27, 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/26sep_8px_steps_mix_paths')

model1 = tf.keras.models.load_model('IRI_models/26sep_8px_steps_mix_vels')

model2 = tf.keras.models.load_model('IRI_models/26sep_8px_steps_mix_stops')
```

2 Variables definition

[ ]:
```
div = 32
step = int(32/4)
red = [8,8,4,4,4,4]

map_list_t = ['master_big','master_big_closed','master_big_semiclosed']
map_root_name = 'master_big'
# map_list = ['stanford_coupa0',␣
 ↪'stanford_coupa3','stanford_hyang1','stanford_hyang10','stanford_gates2','master_big','will
map_list = ['stanford_hyang10',␣
 ↪'stanford_gates2','master_big','willow','costacafe','map3']
```

```
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)
```

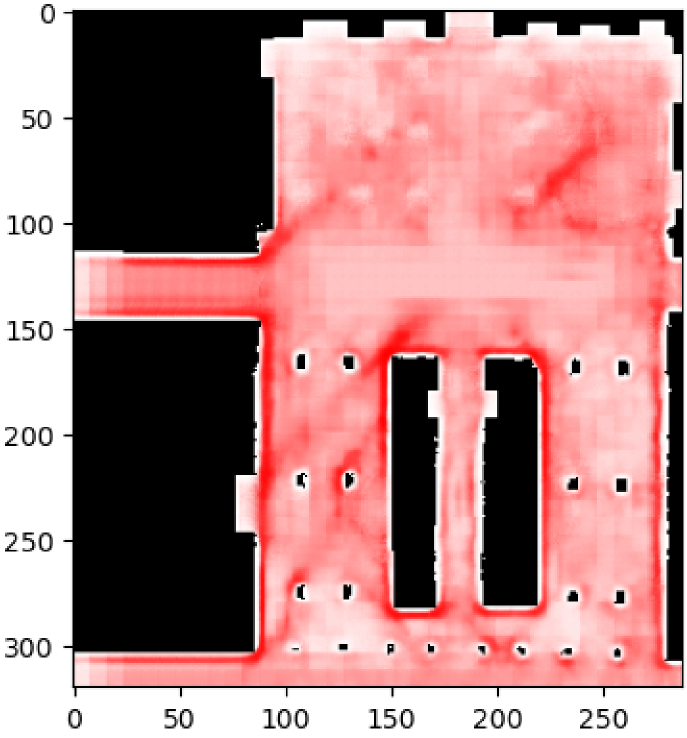
2.1 Testing closed corridors (completely or partially closed)

[ ]:

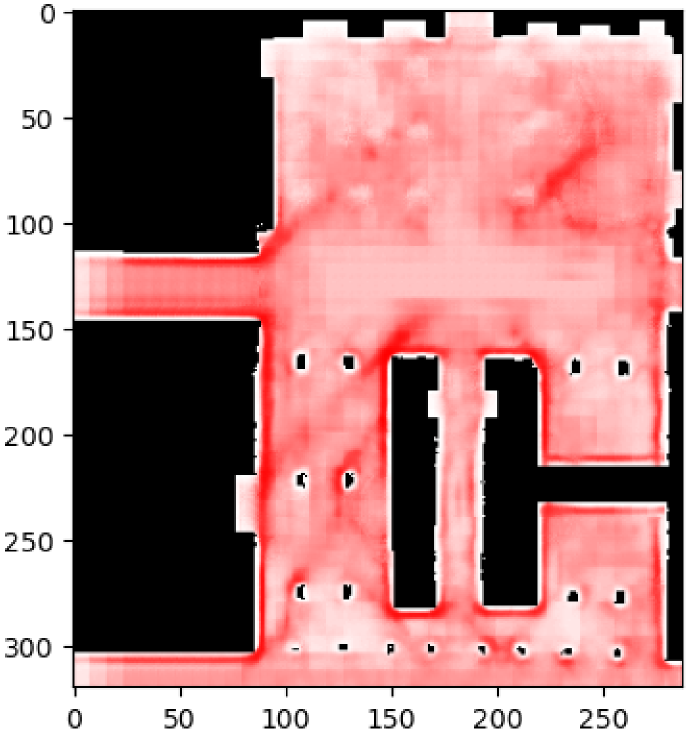
```
for map_name in map_list_t:
  print(map_name)

  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()
```

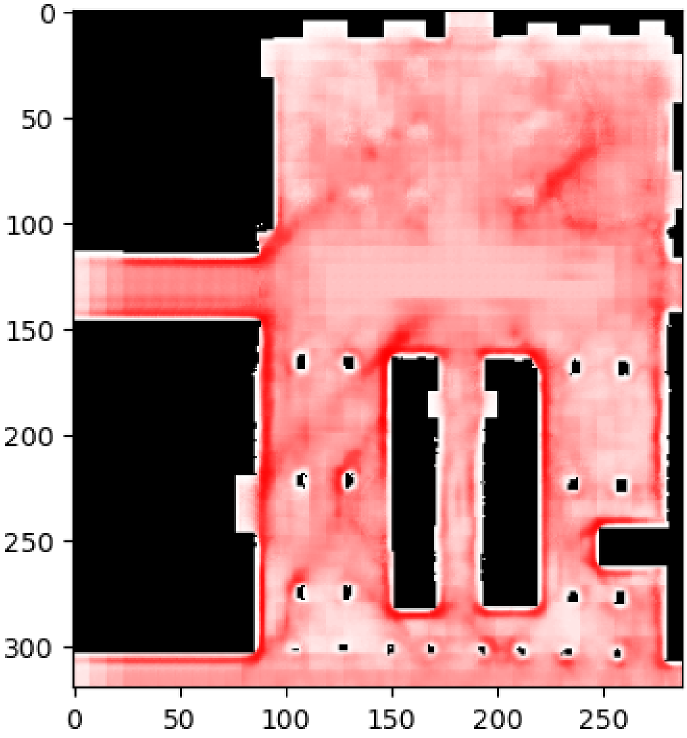
master_big



master_big_closed



master_big_semiclosed



2.2 Model 1 testing

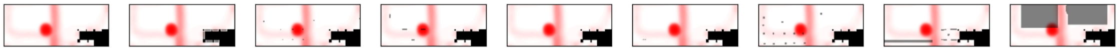
[ ]:

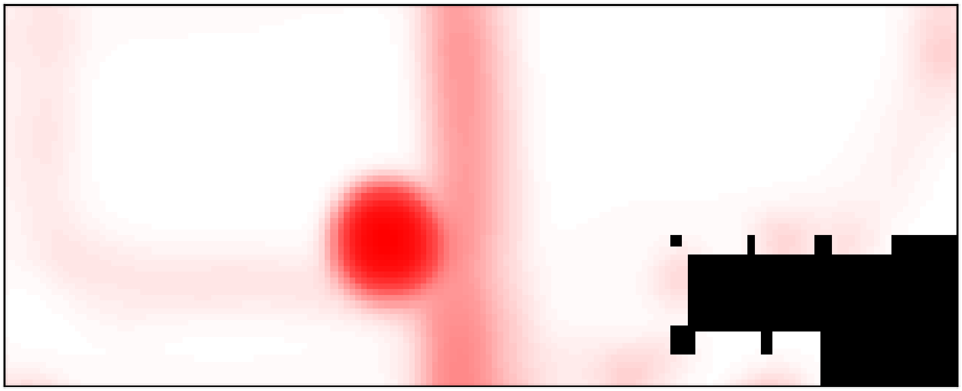
```
kl1 = []

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))
```

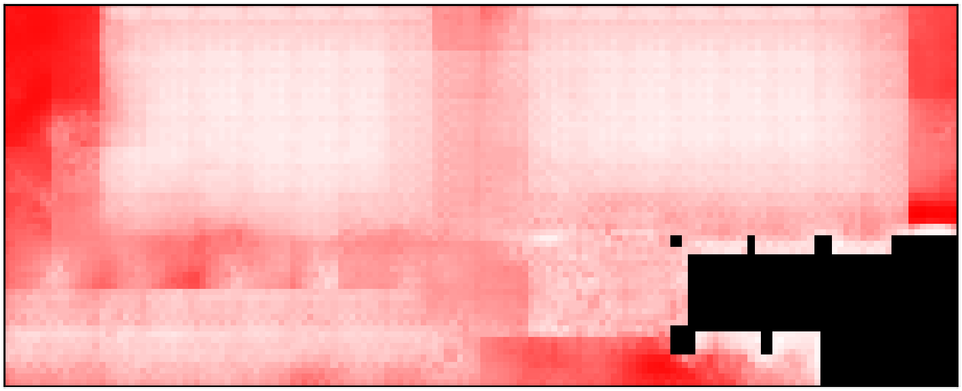
```
# print(data.shape)
hd, wd = data.shape

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)}')
```

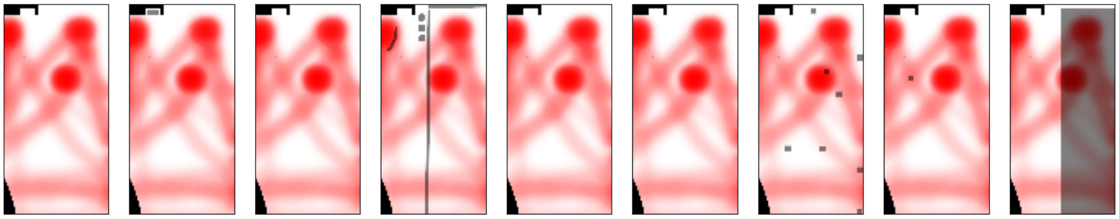
```
stanford_hyang10
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```

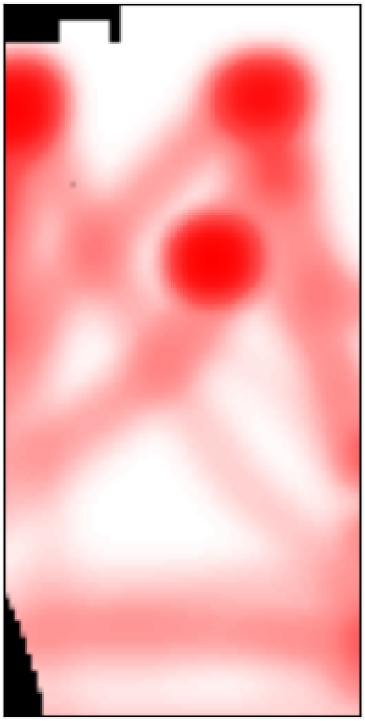


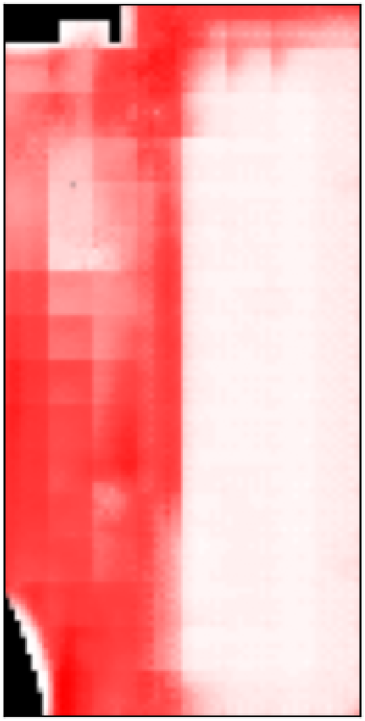




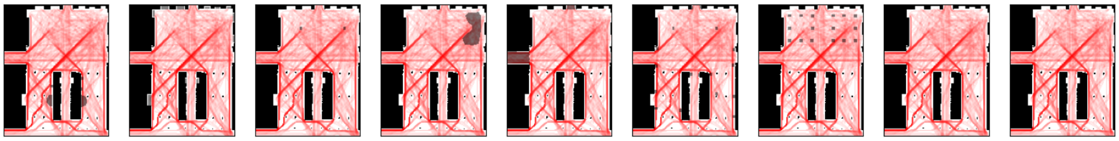
```
KL-divergence: 2.458543359740215
stanford_gates2
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```

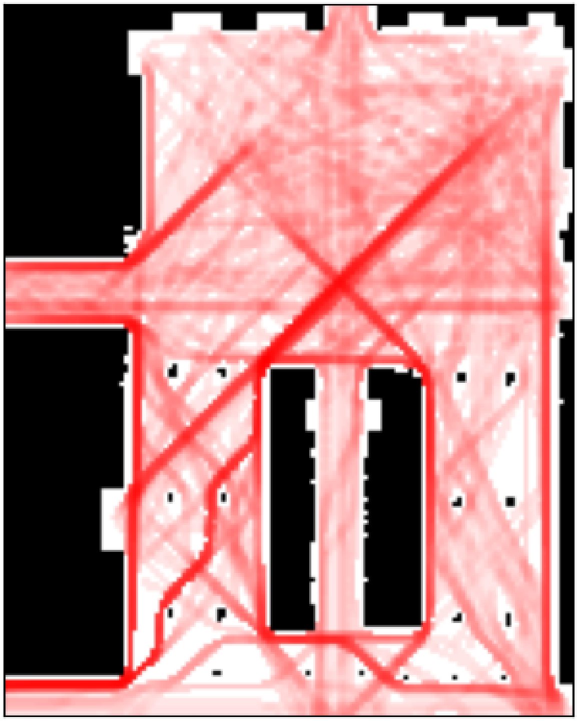


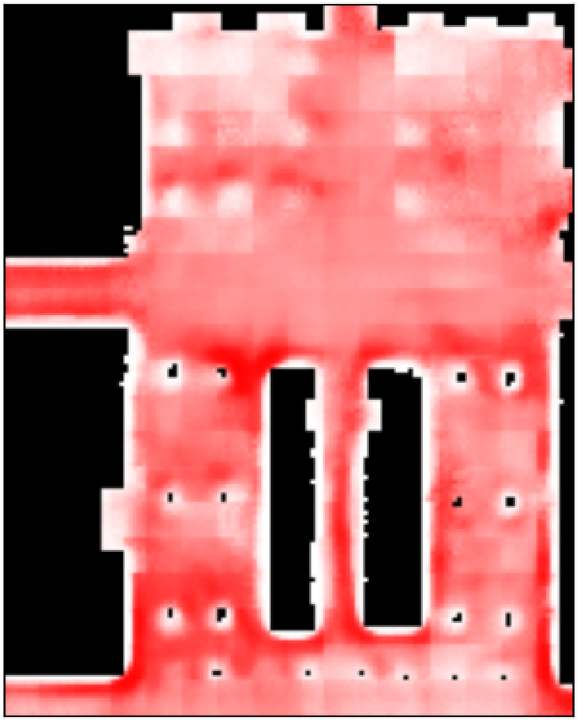




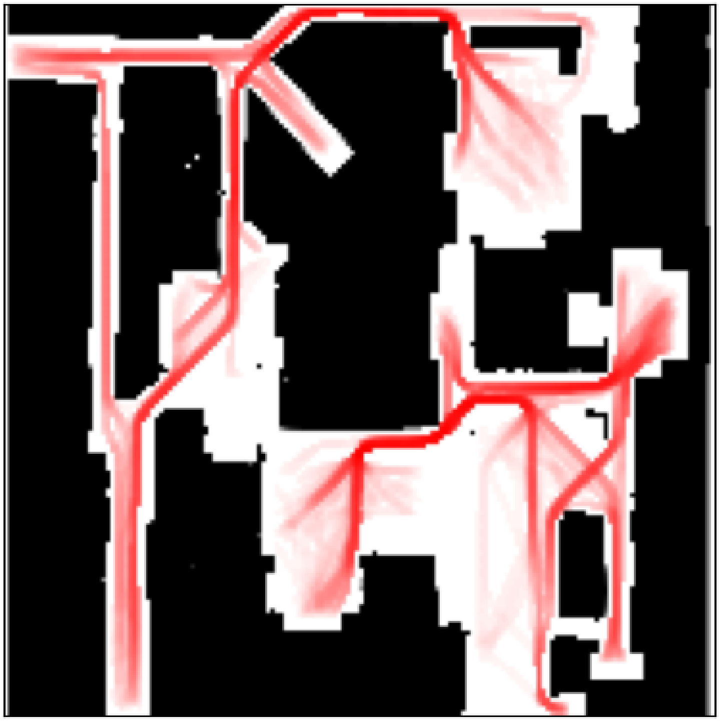
```
KL-divergence: 2.4395372599314795
master_big
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```

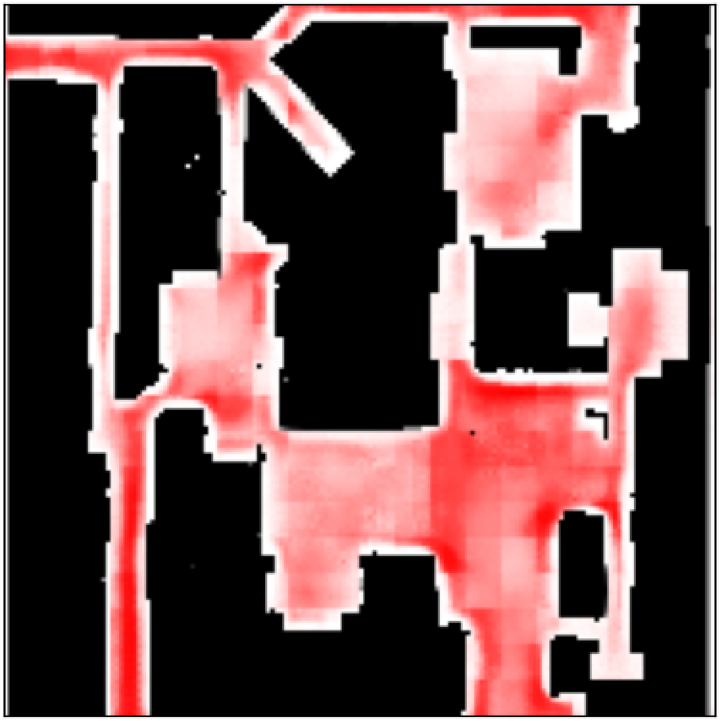




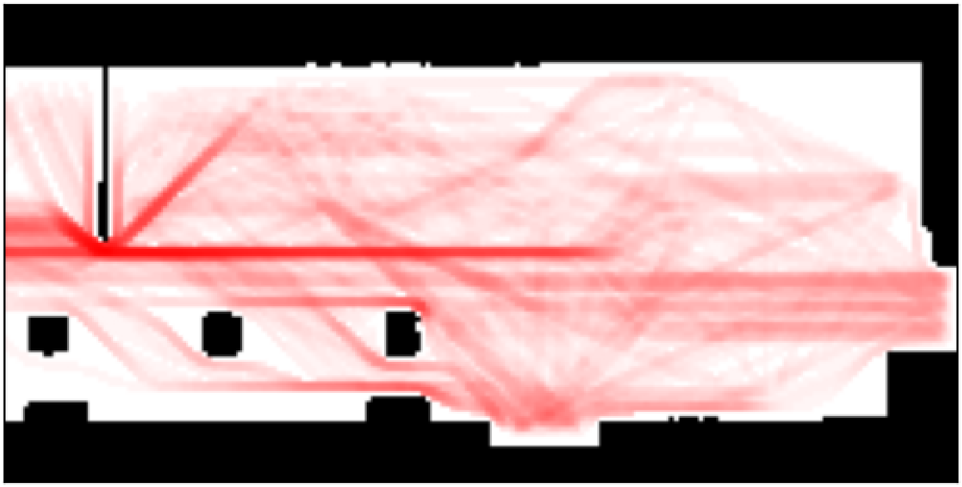


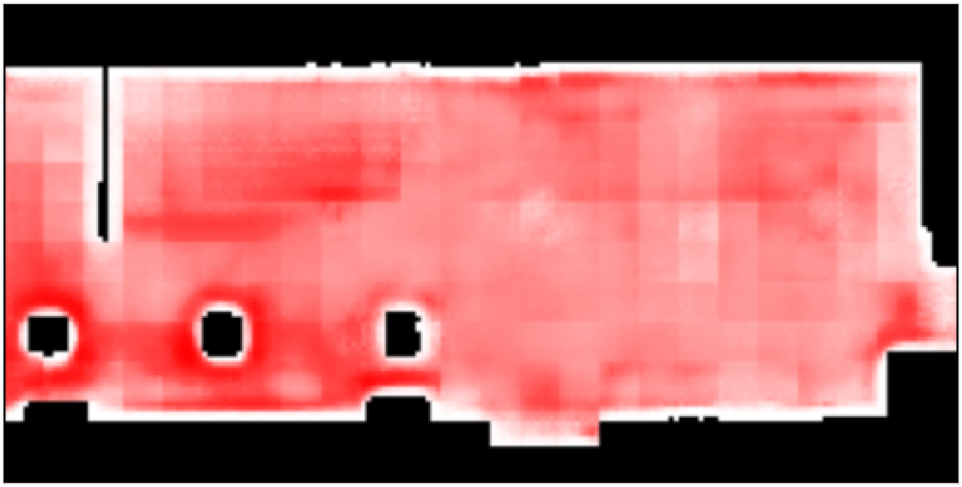
```
KL-divergence: 1.0570437128271506
willow
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```



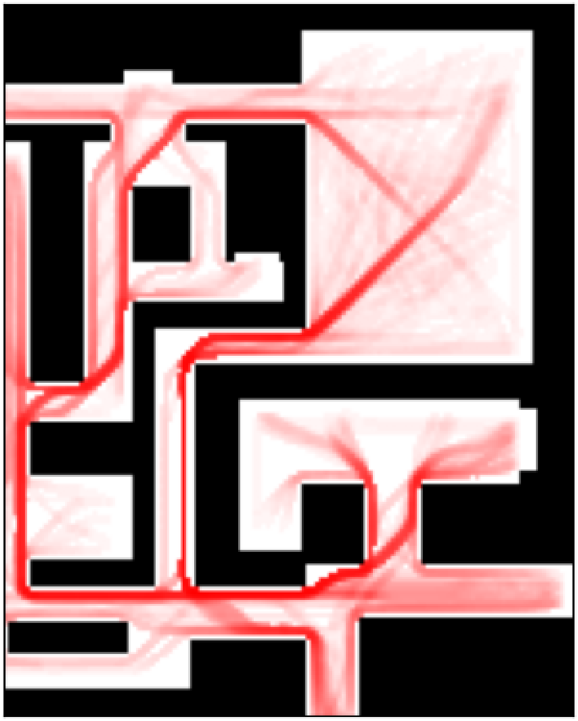


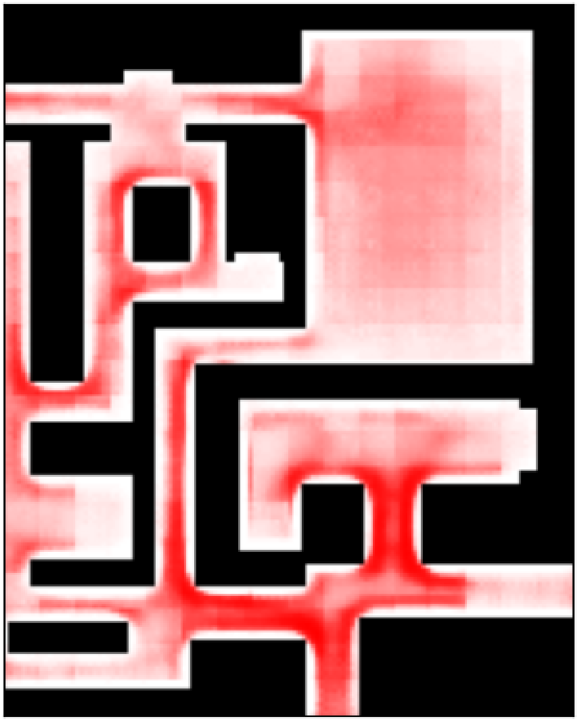
```
KL-divergence: 2.0899011289750917
costacafe
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```





```
KL-divergence: 1.1389788657951534
map3
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```





```
KL-divergence: 1.9192050710030273
Mean KL-divergence: 1.8505348997120195
```

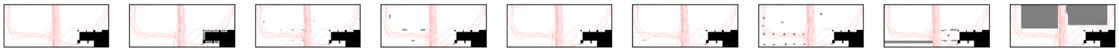
2.3 Model 2 testing

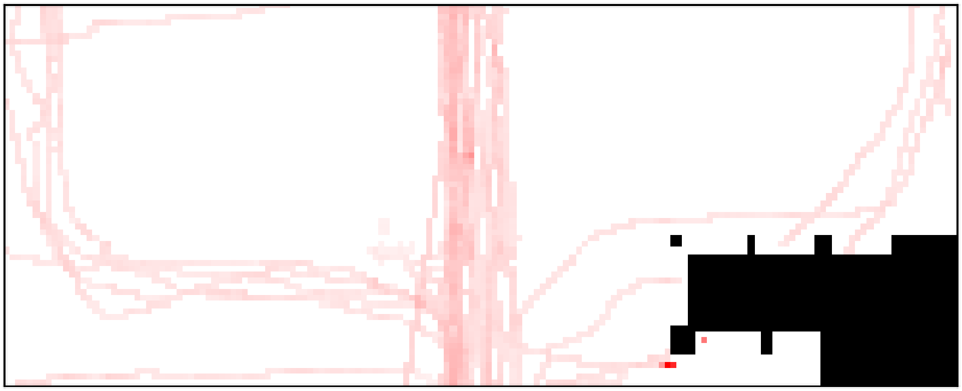
[ ]:
```
kl1 = []

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

#␣
 ↪----------------------------------------------------------------------------------
```

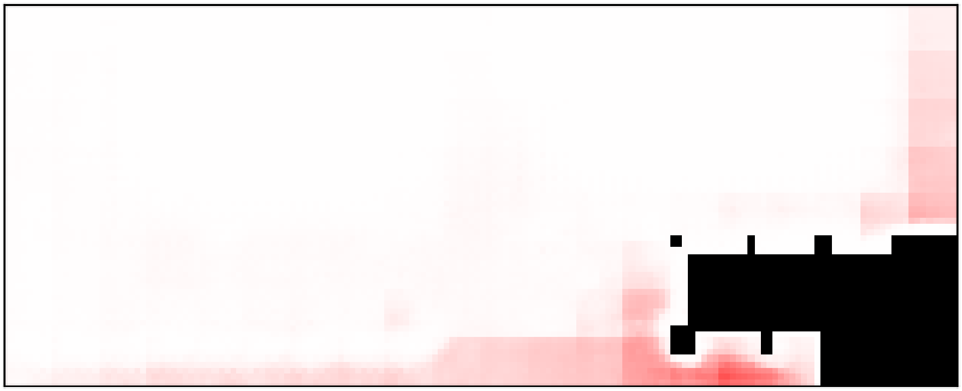
```
lines = 0
with open('maps/semantics/'+map_name+'/humandensity-'+map_name+'-vel.csv') as␣
↪f:
  lines = f.readlines()

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)}')
```

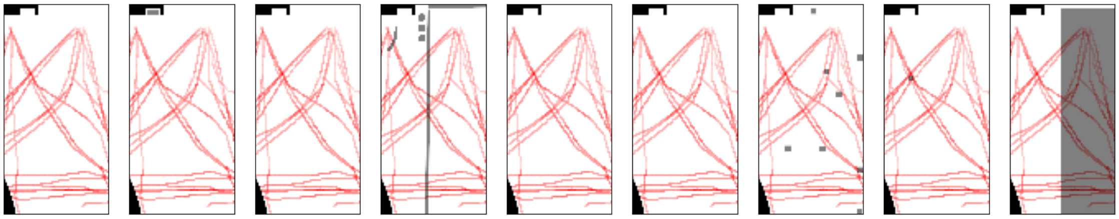
```
stanford_hyang10
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```

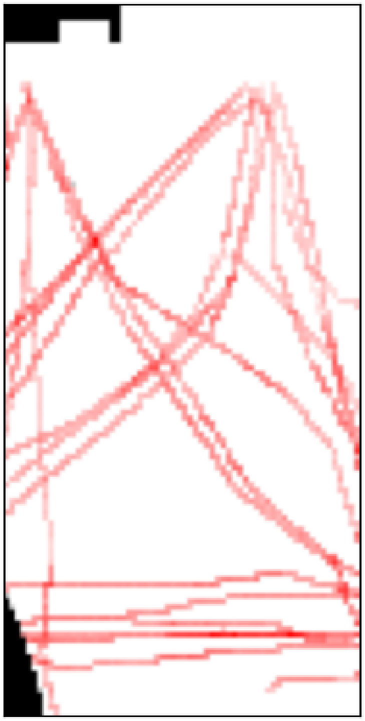


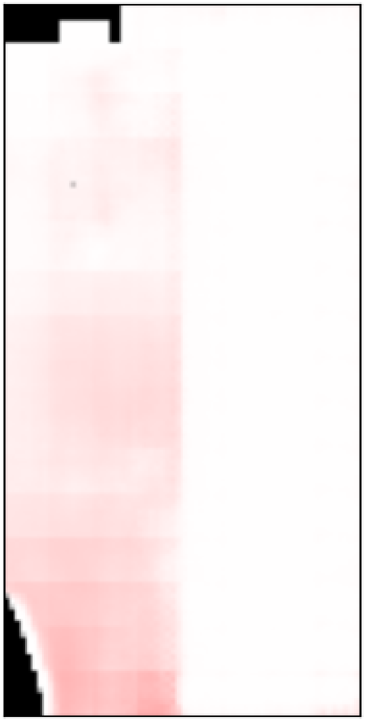




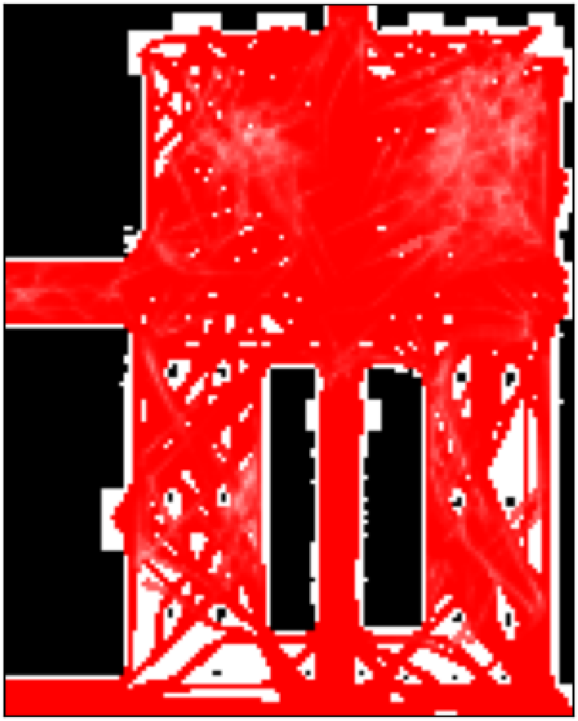
```
KL-divergence: 3.3698415348820725
stanford_gates2
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```

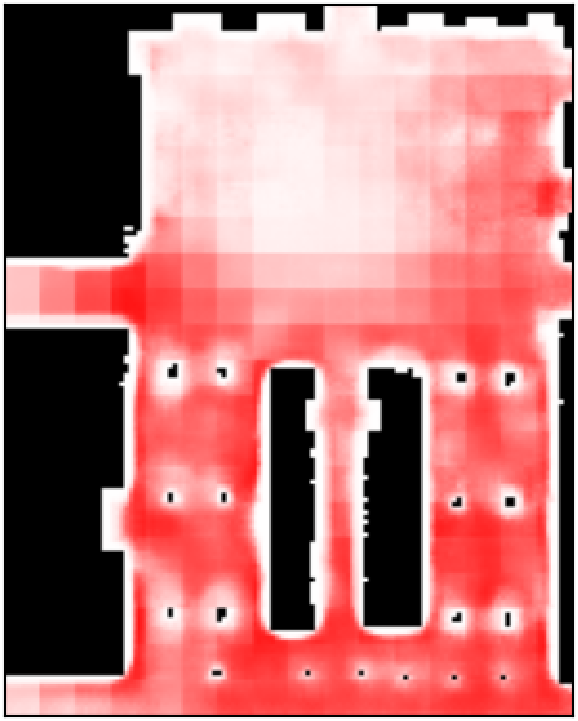




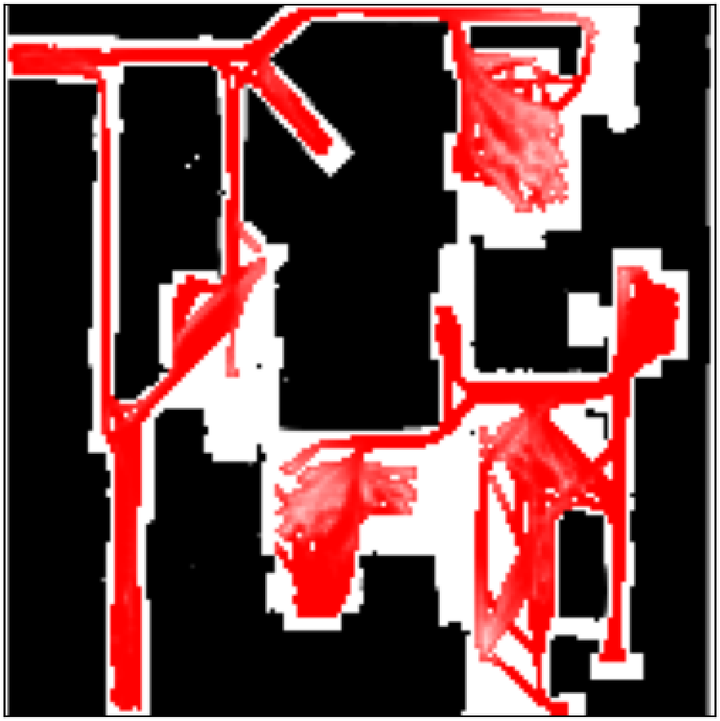


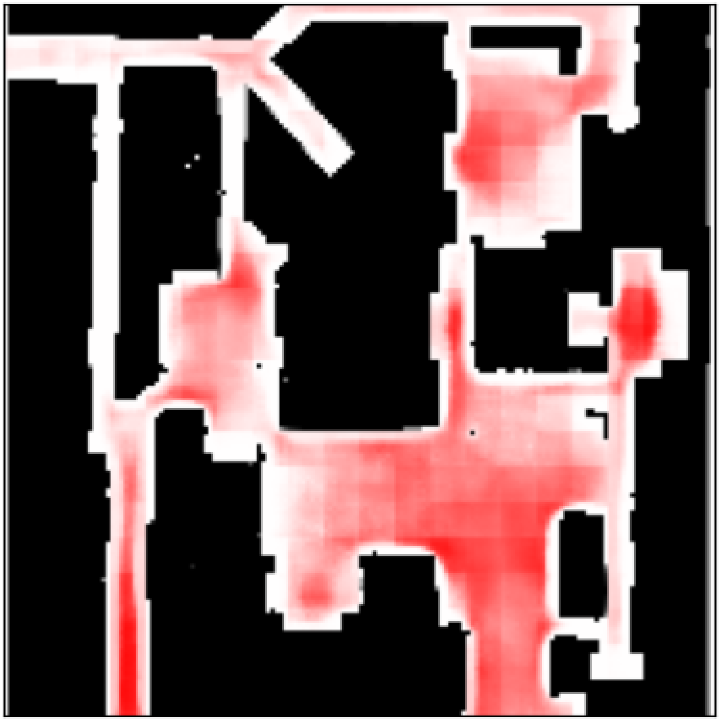
```
KL-divergence: 4.393476275529238
master_big
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```



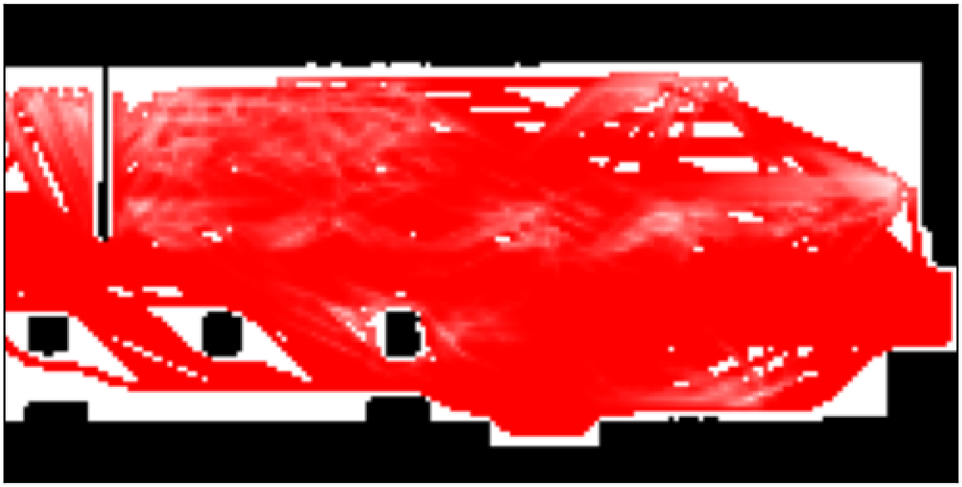


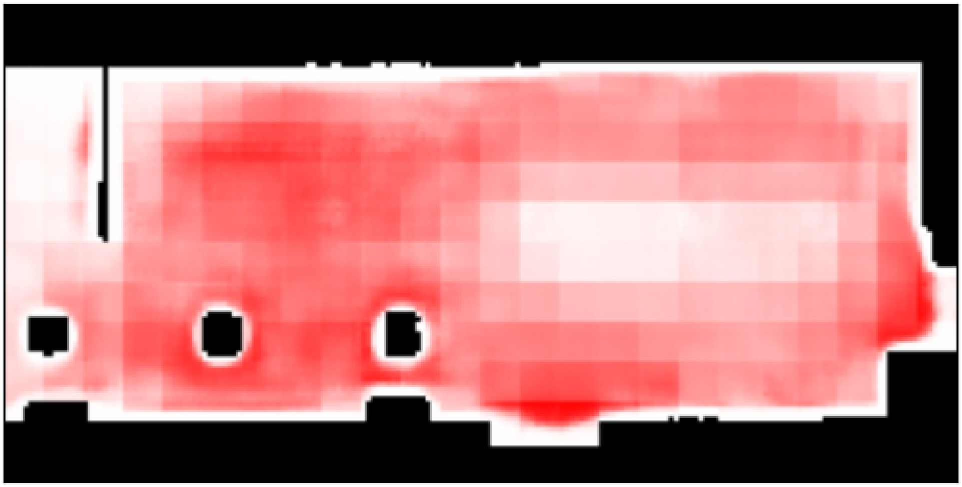
```
KL-divergence: 0.6563648331542629
willow
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```



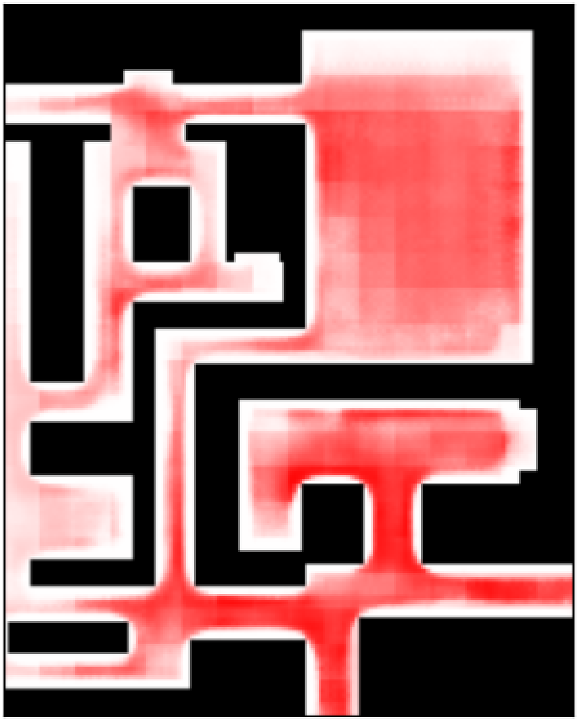


```
KL-divergence: 1.8889541347258212
costacafe
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```





```
KL-divergence: 0.5739543463180902
map3
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```



```
KL-divergence: 1.177627494987443
Mean KL-divergence: 2.0100364365994876
```

2.4 Model 3 testing

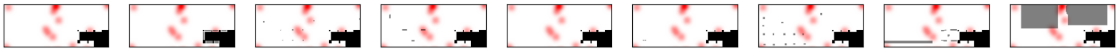
[ ]:

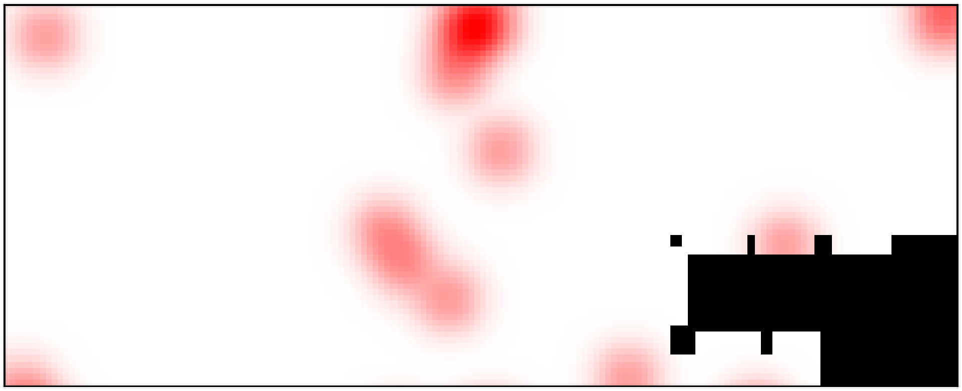
```python
kl1 = []

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

#␣
 ↪-----------------------------------------------------------------------------------
```

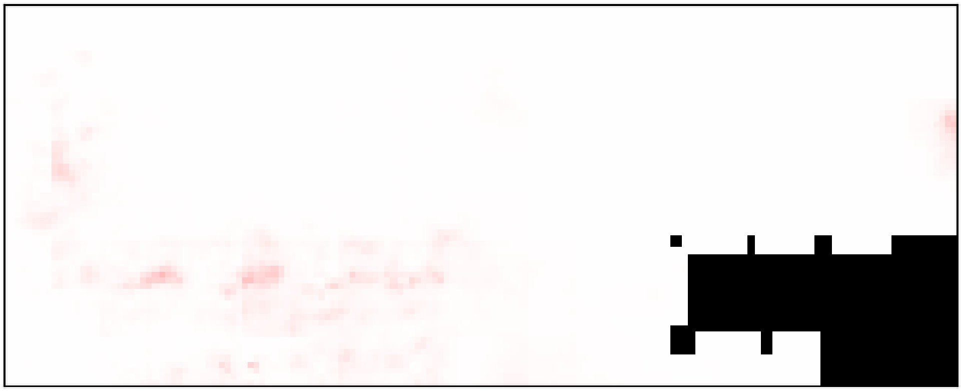
```
lines = 0
with open('maps/semantics/'+map_name+'/humandensity-'+map_name+'-stop.csv')␣
↪as f:
  lines = f.readlines()

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)}')
```

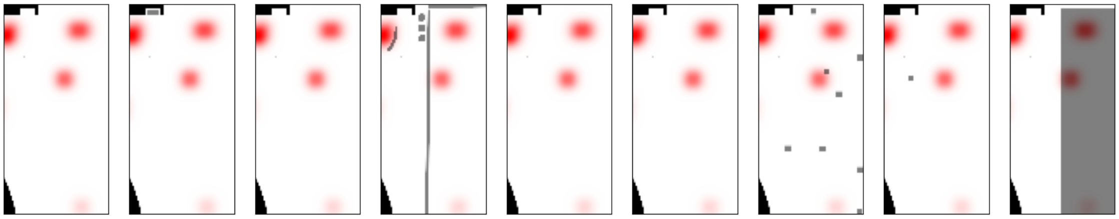
```
stanford_hyang10
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```

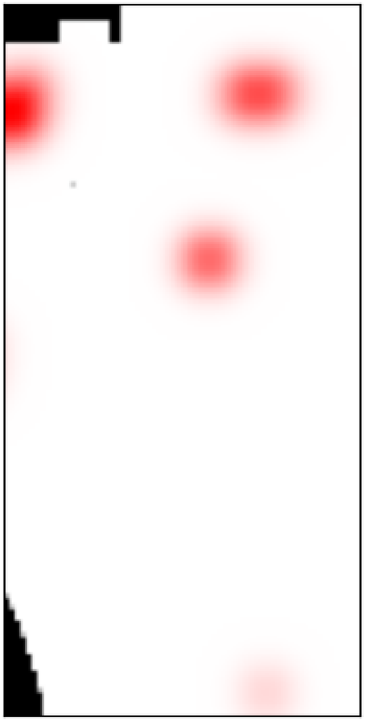




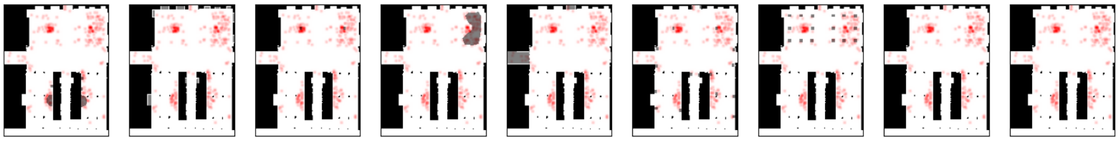


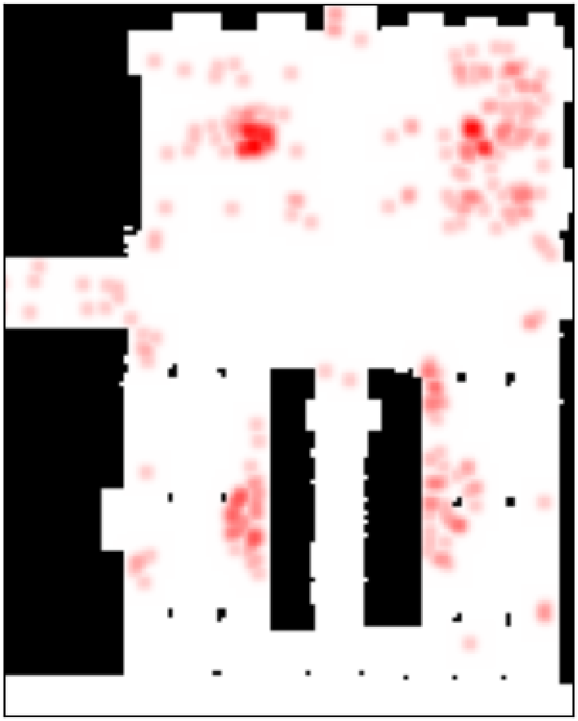
```
KL-divergence: 4.237931090099852
stanford_gates2
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```

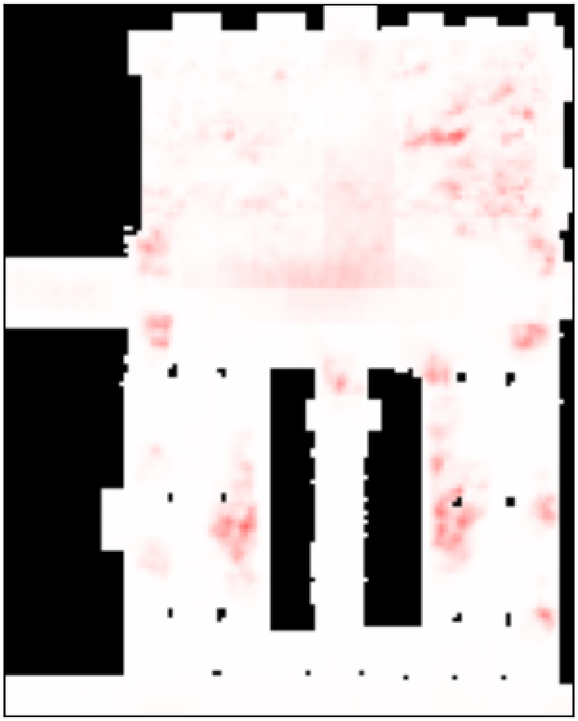




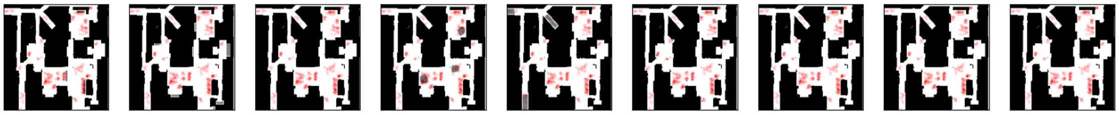
```
KL-divergence: 7.326217665050797
master_big
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```

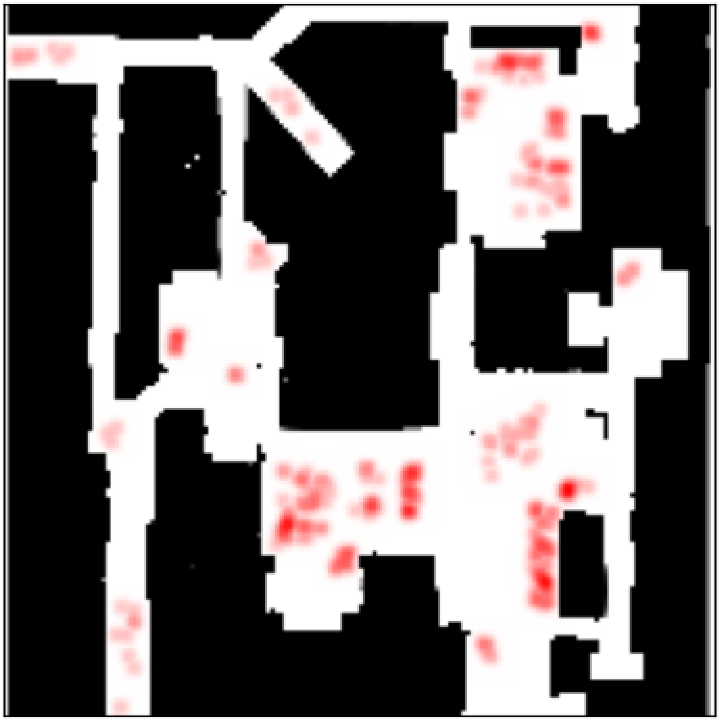


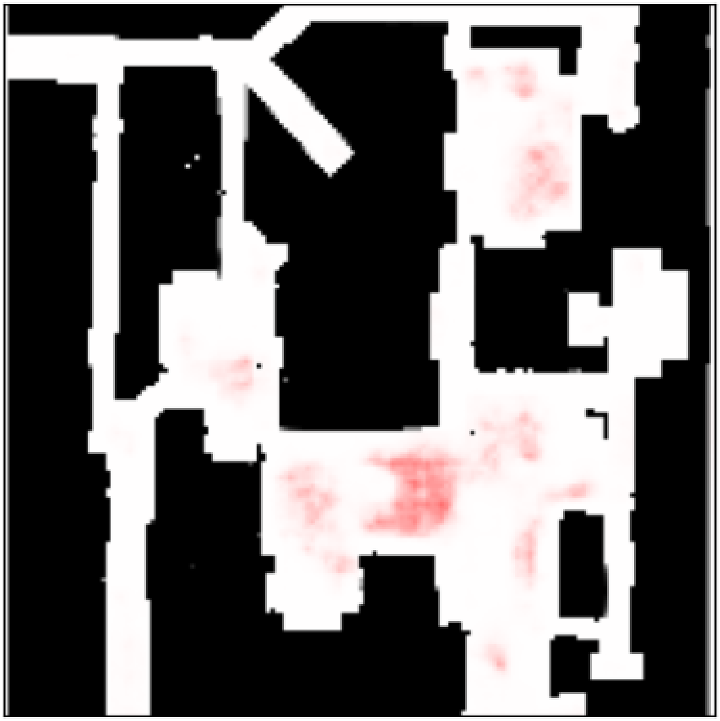




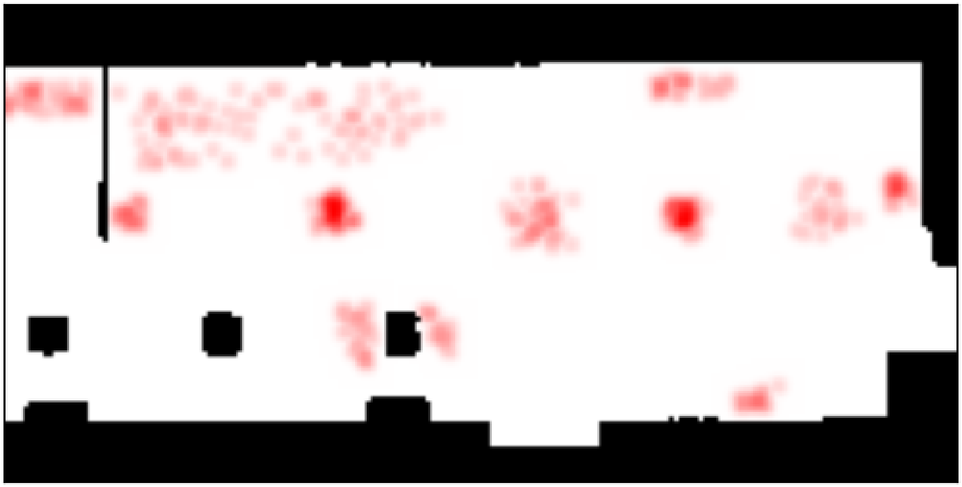
```
KL-divergence: 2.228552932107571
willow
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```

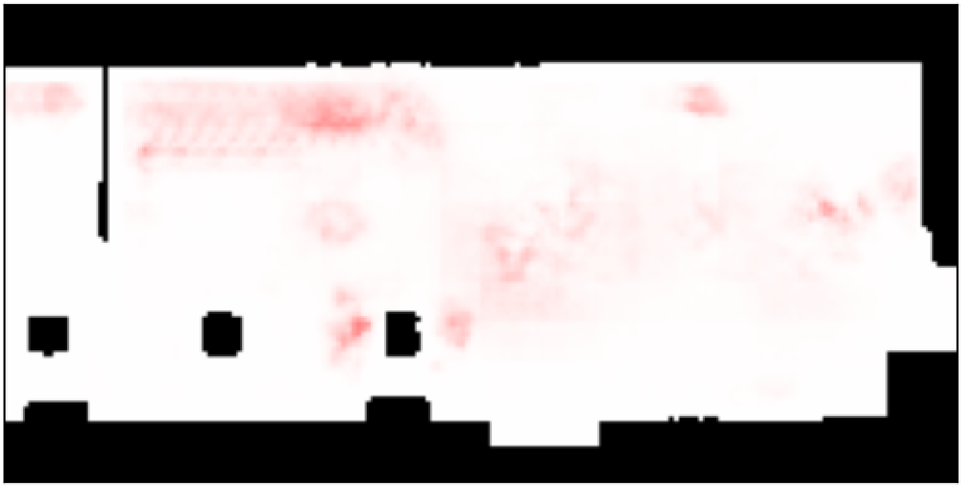




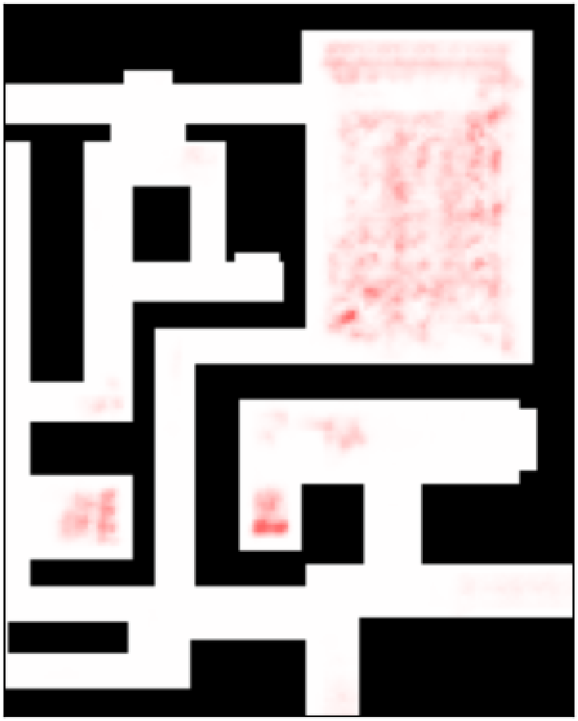


```
KL-divergence: 2.793524285821789
costacafe
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```





```
KL-divergence: 2.1481136218531924
map3
['cash', 'entrance', 'light', 'sit', 'stairs', 'trash', 'tree', 'restricted',
'grass']
```



```
KL-divergence: 1.6994147801746553
Mean KL-divergence: 3.4056257291846426
```