In [2]:

```
import sys
import cv2
import matplotlib.pyplot as plt
import numpy as np
from scipy.misc import imresize
%matplotlib inline
from IPython import display
from keras.models import Sequential, load_model
from keras.layers import Dense, Activation, Dropout, Conv2D, MaxPooling2D, F
from keras.preprocessing import image
from datetime import date, datetime
```

In [3]:

```
labels = ['camera', 'exit sign', 'fire alarm', 'power outlet', 'sprinkler']
```

In [4]:

```
def get_classifier():
    # Initialising the CNN
    classifier = Sequential()

    # Convolution
    classifier.add(Conv2D(32, (3, 3), input_shape = (64, 64, 3), activation
    # Pooling
    classifier.add(MaxPooling2D(pool_size = (2, 2)))
    classifier.add(Dropout(0.25))
    # Adding a second convolutional layer
    classifier.add(Conv2D(32, (3, 3), activation = 'relu'))
    classifier.add(MaxPooling2D(pool_size = (2, 2)))
    classifier.add(Dropout(0.25))
    # Flattening
    classifier.add(Flatten())

    # Full connection
    classifier.add(Dense(units = 64, activation = 'relu'))
    classifier.add(Dropout(0.5))
    classifier.add(Dense(units = 5, activation='softmax'))
    # Compiling the CNN
    classifier.compile(optimizer = 'rmsprop', loss = 'categorical_crossentro
    return classifier
```

In [5]:

```
# Fitting the CNN to the images
train_datagen = image.ImageDataGenerator(rescale=1./255,
                                   rotation_range=180,
                                   width_shift_range=0.3,
                                   shear_range=0.2,
                                   zoom_range=0.2,
                                   horizontal_flip=True,
                                   fill_mode='nearest')
test_datagen = image.ImageDataGenerator(rescale=1./255)
training_set = train_datagen.flow_from_directory('dataset/training_set',
                                                 target_size = (64, 64),
                                                 batch_size = 32,
                                                 class_mode = 'categorical'
test_set = test_datagen.flow_from_directory('dataset/test_set',
                                            target_size = (64, 64),
                                            batch_size = 32,
                                            class_mode = 'categorical')
```

```
Found 80 images belonging to 5 classes.
Found 40 images belonging to 5 classes.
```

In [6]:

```
def fit_classifier(classifier):
    classifier.fit_generator(training_set,
                             steps_per_epoch = 500,
                             epochs = 2,
                             validation_data = test_set,
                             validation_steps = 500,
                             verbose = 2)
```

In [7]:

```
# UNCOMMENT below code ONLY if you want to retrain and save classifier (take
# classifier = get_classifier()
# fit_classifier(classifier)
# classifier.save_weights('cnn_weights_%s.h5' % date.strftime(datetime.now(
# classifier.save('cnn_model_%s.h5' % date.strftime(datetime.now(), '%Y_%m_
```

In [8]:

```
classifier = load_model('cnn_model_final.h5')
```

In [9]:

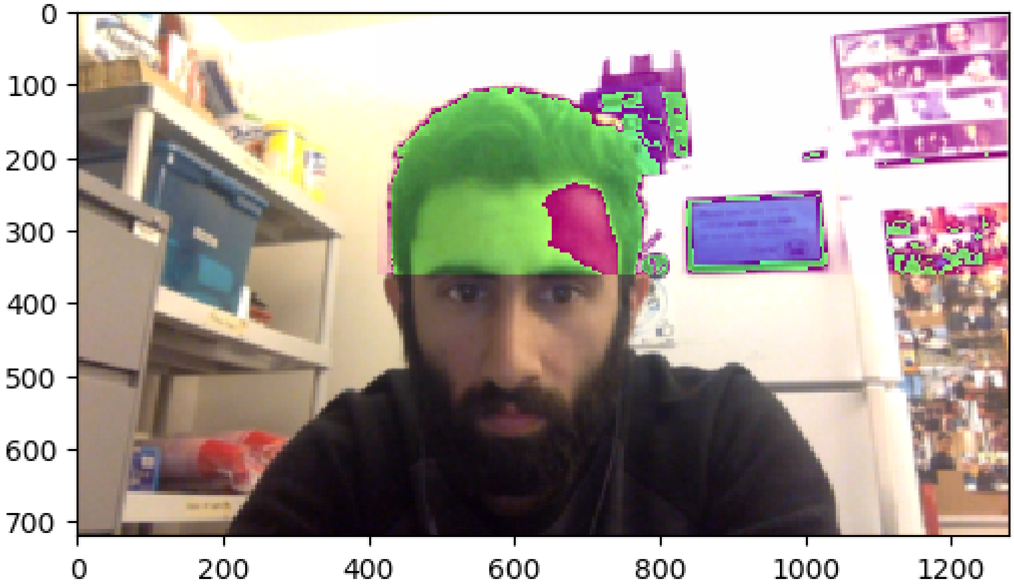
```
# Making new predictions
test_image = image.load_img('dataset/test_set/sprinkler/20180507_234532.jpg
test_image = image.img_to_array(test_image)
test_image = np.expand_dims(test_image, axis=0)
print(test_image.shape)
result = classifier.predict(test_image)
training_set.class_indices
print(result[0])
# plt.title(prediction)
# plt.imshow(test_image[0].astype(float))
# plt.show()
# print(count/14)
```

```
(1, 64, 64, 3)
[0. 0. 0. 0. 1.]
```

```
In [10]: def backproject(source, target, levels = 2, scale = 1):
             hsv = cv2.cvtColor(source,  cv2.COLOR_BGR2HSV)
             hsvt = cv2.cvtColor(target, cv2.COLOR_BGR2HSV)
             # calculating object histogram
             roihist = cv2.calcHist([hsv],[0, 1], None, [levels, levels], [0, 180, 0,

             # normalize histogram and apply backprojection
             cv2.normalize(roihist,roihist,0,255,cv2.NORM_MINMAX)
             dst = cv2.calcBackProject([hsvt],[0,1],roihist,[0,180,0,256], scale)
             return dst

         def saliency_by_backprojection(img):
             cv2.pyrMeanShiftFiltering(img, 2, 10, img, 4)

             backproj = np.uint8(backproject(img, img, levels = 2))
             cv2.normalize(backproj,backproj,0,255,cv2.NORM_MINMAX)
             saliencies = [backproj, backproj, backproj]
             saliency = cv2.merge(saliencies)

             cv2.pyrMeanShiftFiltering(saliency, 20, 200, saliency, 2)
             saliency = cv2.cvtColor(saliency, cv2.COLOR_BGR2GRAY)
             cv2.equalizeHist(saliency, saliency)

             return 255-saliency

         def saliency_map(img):
             saliency_hsv = saliency_by_backprojection(img * 1)
             saliency = saliency_hsv
             (T, saliency) = cv2.threshold(saliency, 200, 255, cv2.THRESH_BINARY)
             return saliency

         def largest_contours_rect(saliency):
             _, contours, hierarchy = cv2.findContours(saliency * 1,cv2.RETR_LIST,cv2
             contours = sorted(contours, key = cv2.contourArea)
             return cv2.boundingRect(contours[-1])

         def refine_saliency_with_grabcut(img, saliency):
             rect = largest_contours_rect(saliency)
             bgdmodel = np.zeros((1, 65),np.float64)
             fgdmodel = np.zeros((1, 65),np.float64)
             saliency[np.where(saliency > 0)] = cv2.GC_FGD
             mask = saliency
             try:
                 cv2.grabCut(img, mask, rect, bgdmodel, fgdmodel, 1, cv2.GC_INIT_WITH
             except:
                 pass
             mask = np.where((mask==2)|(mask==0),0,1).astype('uint8')
             return mask

         def backprojection_saliency(img):
             saliency = saliency_map(img)
             mask = refine_saliency_with_grabcut(img, saliency)
             return mask

         def bounding_box(mask):
             obj = np.where(mask != 0)
```

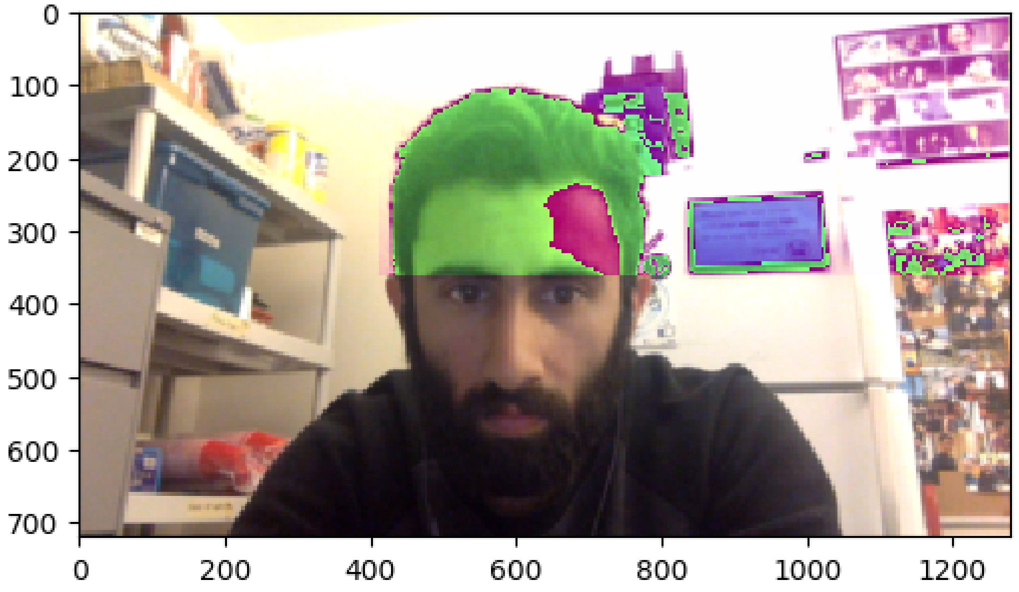
```
    bbox = np.min(obj[0]), np.max(obj[0]), np.min(obj[1]), np.max(obj[1])
    return bbox
```

```
In [12]: vc = cv2.VideoCapture(0)

         if vc.isOpened(): # try to get the first frame
             is_capturing, frame = vc.read()
             frame = cv2.cvtColor(frame, cv2.COLOR_BGR2RGB)    # makes the blues imag
             print(frame.shape)
             webcam_preview = plt.imshow(frame)
         else:
             is_capturing = False

         while is_capturing:
             try:    # Lookout for a keyboardInterrupt to stop the script
                 is_capturing, frame = vc.read()
                 frame_big = cv2.cvtColor(frame, cv2.COLOR_BGR2RGB)    # makes the bl
                 frame = imresize(frame_big, (180, 320, 3))
                 frame_square = imresize(frame[:, 70:250, :], (64, 64, 3))[np.newaxis
                 mask = backprojection_saliency(frame)
                 # segmentation = frame*mask[:,:,np.newaxis]
                 bbox = bounding_box(mask)
                 pred = classifier.predict(frame_square)[0]
                 label = labels[np.array(pred).argmax()]
                 print(label)
                 frame[bbox[0]:bbox[1],bbox[2]:bbox[3],1] = np.clip(2 * frame[bbox[0
                 webcam_preview.set_data(frame)
                 plt.draw()
                 display.clear_output(wait=True)
                 display.display(plt.gcf())

                 plt.pause(1)    # the pause time is = 1 / framerate
             except KeyboardInterrupt:
                 vc.release()
             except Exception as e:
                 print(e)
                 continue
```



```
/opt/concourse/worker/volumes/live/ca251eb6-4989-473b-4e46-71e0f4f3e8d3/v
olume/opencv_1512680485339/work/modules/imgproc/src/color.cpp:11016: erro
```

```
r: (-215) scn == 3 || scn == 4 in function cvtColor
```



In [ ]: