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CLEAN CITY SOLUTION
RESEARCH PROJECT

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INTRODUCTION

Illegal garbage dumps and graffiti in the city is a major concern for the city authorities. Our proposed solution for solving this problem is to train a robot that can drive through the city and detect Garbage from Images and notify the system in real-time about the same. In addition, the robot can clean the garbage if the volume detected is small or else the robot can notify garbage-collecting trucks with an optimized path, which can cover the maximum garbage in the city.

We have planned to use Deep Learning for training the Garbage Detecting Model based on Caffe. The initial task for achieving this solution is to improve and enhance the existing neural network that detects Garbage from Images. We are planning to publish a research paper with enhanced results and improved accuracy rate for garbage detection.

PROGRESS UNTIL DATE

Following tasks are finished until date for the research work:

o Deciding the abstract for the solution and deciding the path to follow during research i.e., enhancing the neural network.

o Detailed study of the research done until date on FCN, Deep Learning and Garbage Detection.
  http://dl.acm.org/citation.cfm?doid=2971648.2971731

o Understanding the current solution and the architecture proposed in the solution.

o Deep research on the underlying technologies and concepts used or required in future for enhancement of the solution.

o Code gathering from the existing solution, which needs to be used for further enhancement and research purpose.
  https://github.com/KudaP/SpotGarbage

o Understanding the code extracted and preparing for its enhancement process.

o Revisiting the concepts of AI, Neural Networks, Caffe Model and Alex Net.

CONCEPTS

Following concepts will be used in research work:

- o Convolutional Neural Network (CNN)
- o Garbage In Images (GINI) Dataset
- o Images Processing and Segmentation
- o Patch Generation

WORK FLOW

Workflow of the solution is as follows:

- o Gather the images in a folder for processing
- o Running the code with first resize the Images to a size appropriate for FCN.
- o Then the Garbage Model trained using the GINI Dataset will predict the garbage in the Images.
- o Images processing and segmentation will be used to draw the patches indicating the Garbage detected.
- o Output Images will be generated for further study.

SAMPLE

Sample Code:

```python
62          try:
63              test_image = resizeForFCN(images[i],size)
64
65              in_ = np.array(test_image,dtype = np.float32)
66              in_ = in_[:,:,::-1]
67              in_ -= np.array(mean.mean(1).mean(1))
68              in_ = in_.transpose((2,0,1))
69
70              net.blobs['data'].reshape(1,*in_.shape)
71              net.blobs['data'].data[...] = in_
72              net.forward()
73
74              probMap =net.blobs['prob'].data[0,1]
75              print names[i]+'...',
76              if len(np.where(probMap>thresh)[0]) > 0:
77                  print 'Garbage!'
78              else:
79                  print 'Not Garbage!'
80
81              out_ = getSegmentedImage(test_image, probMap,thresh)
82              out_.save(output_folder + '/output_' + names[i])
83          except:
84              pass
85
86
87  mean_filename='SpotGarbage_GarbNet/garbnet_mean.binaryproto'
88  deploy_filename = 'SpotGarbage_GarbNet/deploy_garbnet.prototxt'
89  caffemodel_file = 'SpotGarbage_GarbNet/garbnet_fcn.caffemodel'
90
```

Sample Input:

Sample Output: