Machine Learning for Computer Vision

Exercise 2

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1 Iterated Conditional Models

The missing code is:

```
# unary terms
energy += unaries[x0,x1,l]

# pairwise terms
energy += 4 - [labels[x0-1,x1], labels[x0+1,x1],
            labels[x0,x1-1], labels[x0,x1+1]].count(l)
```

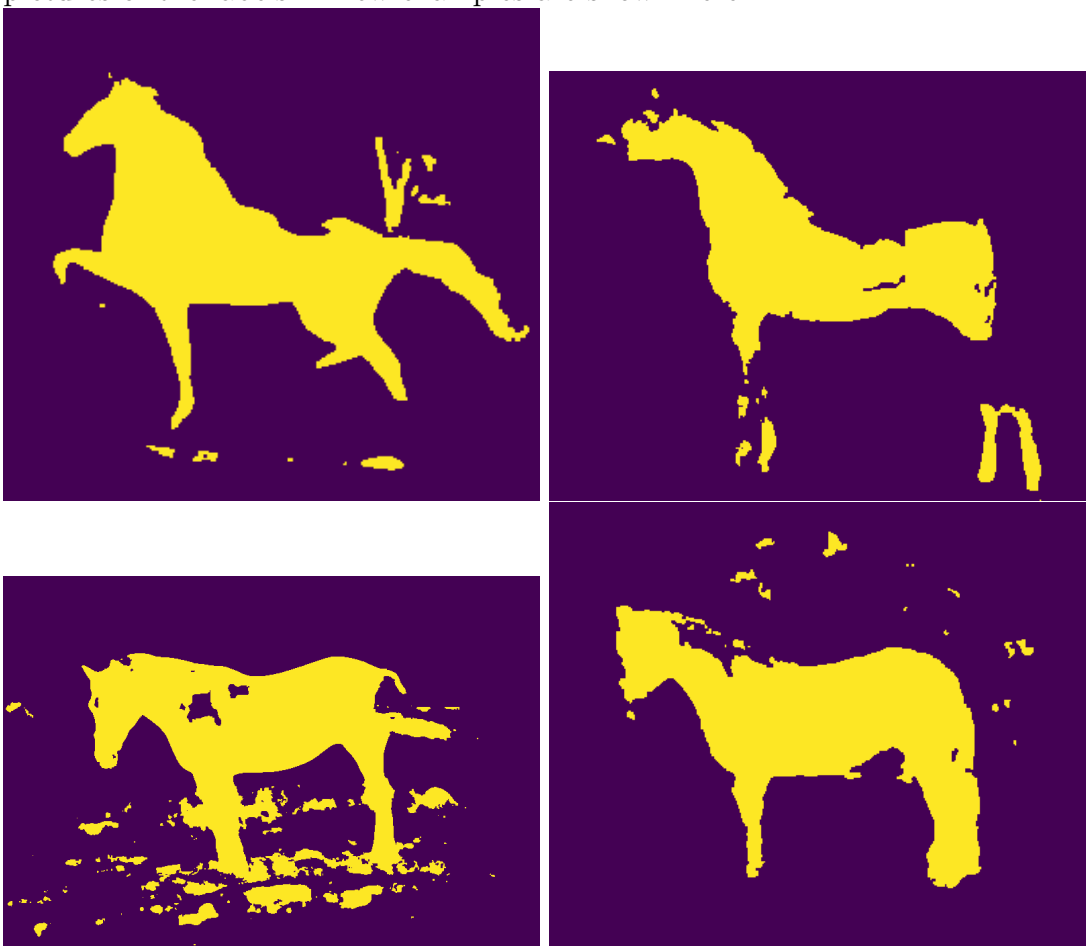
The code to use probability pictures as unaries is:

```
# import predictions from exercise1
# prediction images are in folder predictions/
pred_paths = glob.glob("predictions/*")
pred = [skimage.img_as_float(skimage.io.imread(f)) for f in pred_paths]

# Getting rid of the zeros
for x in numpy.nditer(pred[0], op_flags=['readwrite']):
    if x == 0:
        x[...] = 1e-100
    if x == 1:
        x[...] = 1. - 1e-16

fg = -numpy.log(pred[0])
bg = -numpy.log(1.-pred[0])
unaries = numpy.dstack((fg, bg))
```

Changing beta doesn't do anything since it isn't used in the function.
In the whole program (source below) there is also an addition at the end to produce pictures of the labels. A few examples are shown here:



2 Higher order factors

The domain of x_z is $\{0, 1, 2, 3, 4, 5, 6, 7\}$. Each variable value represents one energy state. The pairwise factors are given in the following table:

x_z	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
x_0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
ϕ_{0z}	a	b	c	d			∞				∞			e	f	g	h
x_z	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
x_1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
ϕ_{1z}	0	0		∞		0	0		∞		∞		0	0		∞		0	0
x_z	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
x_1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
ϕ_{1z}	0	∞	0	∞	0	∞	0	∞	∞	0	∞	0	∞	0	∞	0

By using infinity in the pairwise factors, for any value for x_z there is only one value that each x_i can have which correspond with the energy given by ϕ_{012}.