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from sklearn.utils import gen_even_slices
import numpy as np
import itertools

class RBM:
    def __init__(self, num_hidden, num_visible, learning_rate, max_epochs=10,
                 batch_size=10):
        self.num_hidden = num_hidden
        self.num_visible = num_visible
        self.learning_rate = learning_rate
        self.weights = 0.1 * np.random.randn(self.num_visible, self.num_hidden)
        self.weights = np.insert(self.weights, 0, 0, axis = 0)
        self.weights = np.insert(self.weights, 0, 0, axis = 1)
        self.max_epochs = max_epochs
        self.batch_size = batch_size

    def run_visible(self, data):
        num_examples = data.shape[0]

        hidden_states = np.ones((num_examples, self.num_hidden + 1))

        data = np.insert(data, 0, 1, axis = 1)

        hidden_activations = np.dot(data, self.weights)
        hidden_probs = self._logistic(hidden_activations)
        hidden_states[:, :] = hidden_probs > \
            np.random.rand(num_examples, self.num_hidden + 1)
        hidden_states = hidden_states[:, 1:]
        return hidden_states

    def run_hidden(self, data):
        num_examples = data.shape[0]

        visible_states = np.ones((num_examples, self.num_visible + 1))

        data = np.insert(data, 0, 1, axis = 1)

        visible_activations = np.dot(data, self.weights.T)
        visible_probs = self._logistic(visible_activations)
        visible_states[:, :] = visible_probs > \
            np.random.rand(num_examples, self.num_visible + 1)

        visible_states = visible_states[:, 1:]
        return visible_states

    def _logistic(self, x):
        return 1.0 / (1 + np.exp(-x))

    def _fit(self, v_pos):
        h_pos = self.run_visible(v_pos)
        v_neg = self.run_hidden(self.h_samples_)
        h_neg = self.run_visible(v_neg)
        lr = float(self.learning_rate) / v_pos.shape[0]
        v_pos = np.insert(v_pos, 0, 1, axis = 1)

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h_pos = np.insert(h_pos, 0, 1, axis = 1)
v_neg = np.insert(v_neg, 0, 1, axis = 1)
h_neg = np.insert(h_neg, 0, 1, axis = 1)
update = np.dot(v_pos.T, h_pos).T
update -= np.dot(h_neg.T, v_neg)
self.weights += lr * update.T
h_neg[np.random.rand(h_neg.shape[0], h_neg.shape[1]) < h_neg] = 1.0 # sample bin
self.h_samples_ = np.floor(h_neg, h_neg)[:,:1:]

def fit(self, data):
    num_examples = data.shape[0]
    self.h_samples_ = np.zeros((self.batch_size, self.num_hidden))
    n_batches = int(np.ceil(float(num_examples) / self.batch_size))
    batch_slices = list(gen_even_slices(n_batches * self.batch_size,
                                        n_batches, num_examples))

    for iteration in xrange(1, self.max_epochs + 1):
        for batch_slice in batch_slices:
            self._fit(data[batch_slice])

if __name__ == "__main__":
    import numpy as np
    X = np.array([[0, 0, 0], [0, 1, 1], [1, 0, 1], [1, 1, 1]])
    model = RBM(num_hidden=2, num_visible=3, learning_rate=0.1, batch_size=2)
    model.fit(X)
    print model.weights

import numpy as np, gzip, sys
from sklearn import neighbors
from sklearn.cross_validation import train_test_split
from sklearn.linear_model import LogisticRegression

np.random.seed(0)
S = 1000

f = gzip.open('/tmp/mnist.pkl.gz', 'rb')
train_set, valid_set, test_set = cPickle.load(f)
f.close()

X_train, y_train = train_set
X_test, y_test = valid_set
X_train = X_train[:S]; y_train = y_train[:S]
X_test = X_test[:S]; y_test = y_test[:S]
print X_train.shape

clf = neighbors.KNeighborsClassifier(n_neighbors=1)
clf.fit(X_train, y_train)
print 'KNN', clf.score(X_test, y_test)

import rbmp
r = rbmp.RBM(num_hidden=500, learning_rate=0.1, max_epochs=200, num_visible=784, batch_size=10)
r.fit(X_train)
clf = LogisticRegression(C=1000)
clf.fit(r.run_visible(X_train), y_train)
res3 = clf.predict(r.run_visible(X_test))

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print 'RBM', np.sum(res3==y_test) / float(len(y_test))
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http://videolectures.net/icml09_tieleman_ufw/

<http://www.iro.umontreal.ca/~lisa/deep/data/mnist/mnist.pkl.gz>