3-Earth_Movers_Distance

February 15, 2018

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In [1]: import tensorflow as tf
        import tf_emddistance
        import numpy as np
        import matplotlib.pyplot as plt
        from ipywidgets import FloatProgress
        from IPython.display import display
```

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/home/marcus/anaconda3/lib/python3.6/site-packages/h5py/__init__.py:34: FutureWarning: Convers
  from ._conv import register_converters as _register_converters
```

```
In [2]: # Generate 100 circles with radii in the range [0, 10)
        num_samples = 500
        radii = np.arange(0, 10, 0.1)
        num_clouds = len(radii)
        S = np.zeros((num_clouds, num_samples, 3)) # Cricles -> [100, 500, 3]
        for i, r in enumerate(radii):
            # Sample the circumference
            for j in range(num_samples):
                S[i, j, 0] = np.cos(2*np.pi * j / num_samples) * r
                S[i, j, 1] = np.sin(2*np.pi * j / num_samples) * r
                S[i, j, 2] = 0
        S_feed = S
```

```
In [3]: tf.reset_default_graph()

        # Variable X -> [500, 3]
        # Point cloud with which to minimize the EMD distance to
        X = tf.get_variable("X", initializer=tf.random_normal((num_samples, 3), stddev=1.0))

        # Stack X into 100 replicas -> [100, 500, 3]
        X_stacked = tf.stack([X for _ in range(num_clouds)])

        # Placeholder for input point clouds -> [100, 500, 3]
        S = tf.placeholder(tf.float32, [num_clouds, num_samples, 3])

        # Calculate EMD distance
        dist, idx1, idx2 = tf_emddistance.emd_distance(X_stacked, S)
        # The loss will be the average of all the distances of the points
        loss = tf.reduce_mean(dist)
```

emd

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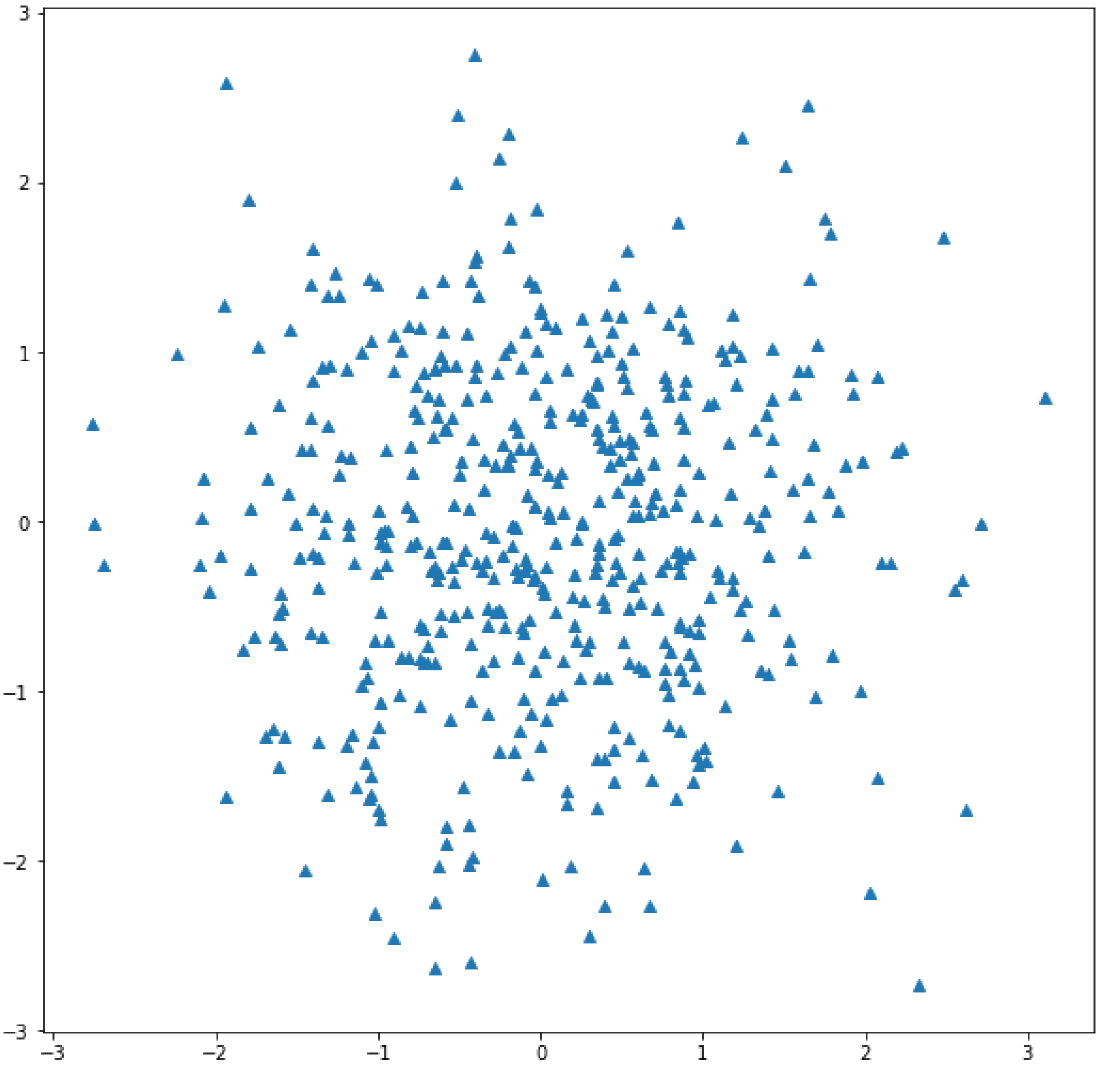
In [4]: def visualize(X):
            plt.figure(figsize=(10, 10))
            plt.scatter(X[:, 0], X[:, 1], marker='^', c="C0")
            plt.show()

        sess = tf.InteractiveSession()
        tf.global_variables_initializer().run()
        visualize(sess.run(X))
```



```
In [5]: # Define optimizer
        optim = tf.train.AdamOptimizer(learning_rate=0.1).minimize(loss)
        tf.global_variables_initializer().run()

        # Minimize the loss
        num_iter = 100
        loss_values = []
        progress = FloatProgress(min=0, max=num_iter); display(progress)
        for i in range(num_iter):
            progress.description = "Epoch %i/%i" % (i, num_iter)
            _, l = sess.run([optim, loss], feed_dict = { S: S_feed })
            loss_values.append(l)
            progress.value += 1
```

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A Jupyter Widget
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In [6]: plt.plot(loss_values)
        plt.show()
```
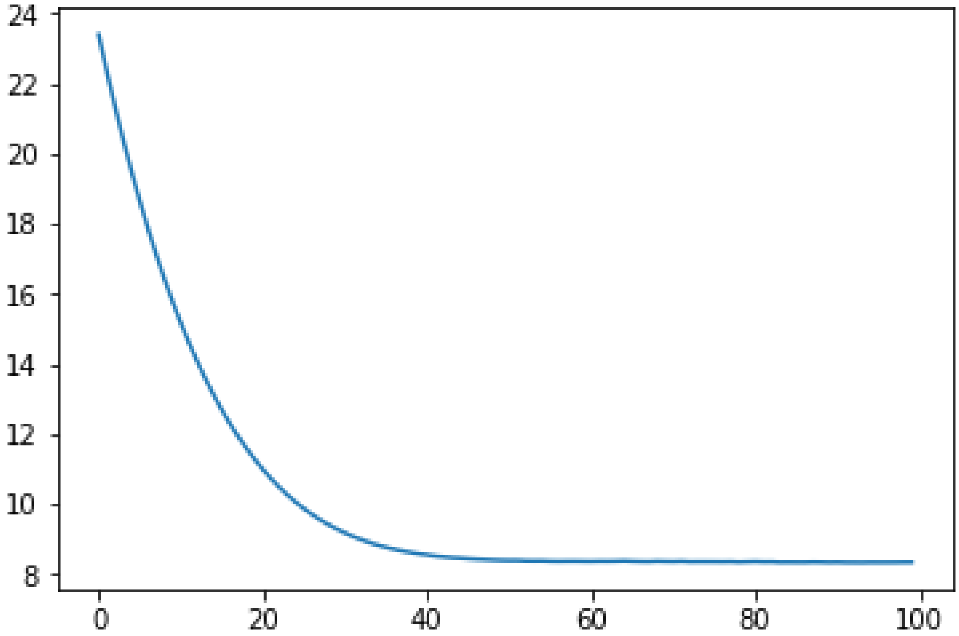
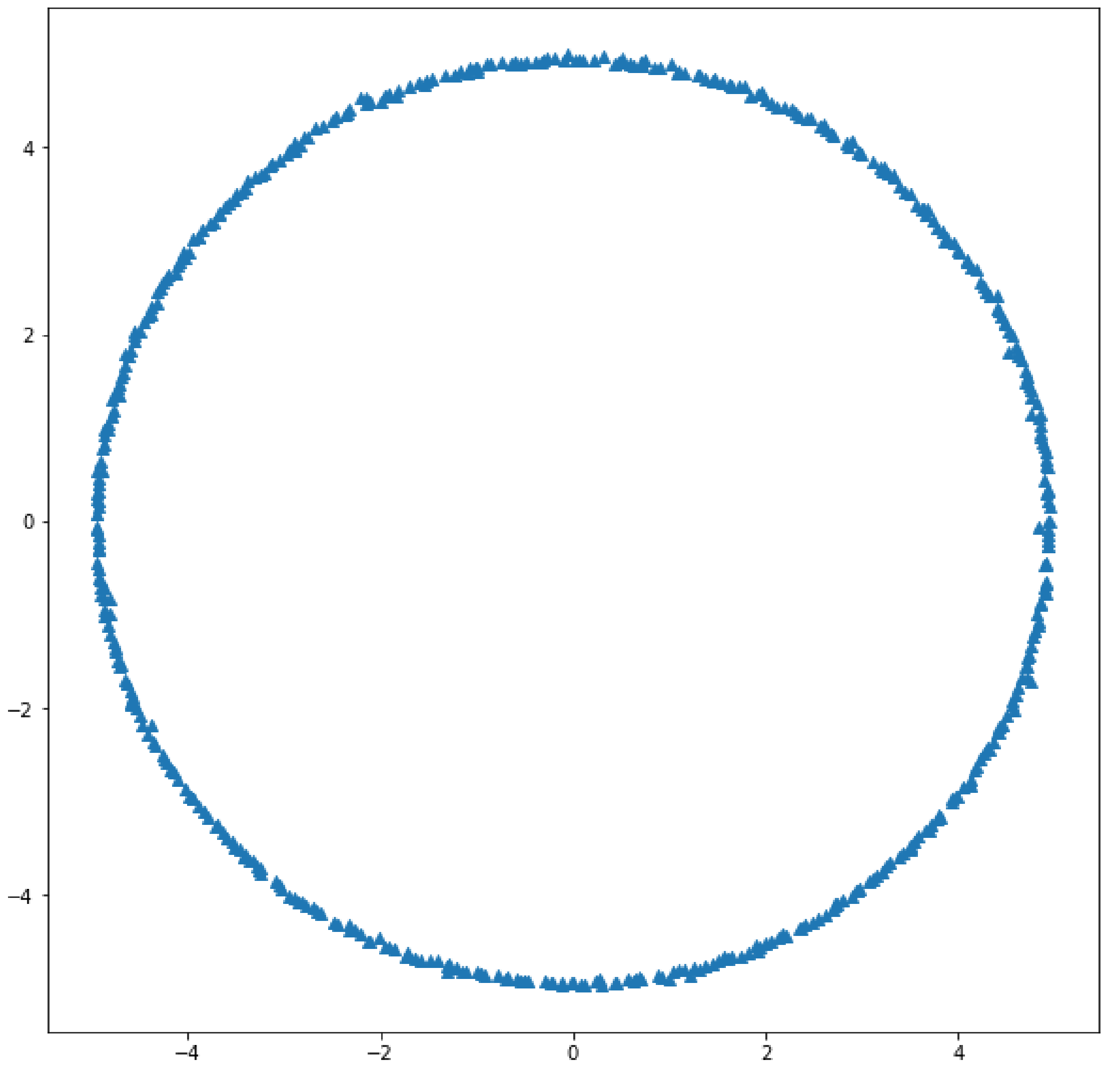



```
In [7]: visualize(sess.run(X))
```


4
2
0
−2
−4
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2
4