Domain specific applications

In addition to the default features (array, dataframe, bag etc.) offered by Dask, there are additional domain-specific modules. We are looking at two of them here: machine learning and image processing.

dask_ml

Just like dask-array is a port of Numpy to Dask, dask_ml is a port from sckit-learn to Dask. Scikit-learn is currently probably the most popular machine-learning package in Python. Dask offers a subset of function available in scikit-learn using the same syntax. Let's see an example. The calculation is **only for the purpose of illustration** and is not realistic.

We look again at the taxi dataset:

In [1]:
```
from dask.distributed import Client

client = Client("tcp://127.0.0.1:49550")
client
```

Out[1]:

Client
Scheduler: tcp://127.0.0.1:49550
Dashboard: http://127.0.0.1:8787/status (http://127.0.0.1:8787/status)

Cluster
Workers: 4
Cores: 4
Memory: 17.18 GB

In [2]:
```
import dask.dataframe as dd
```

In [24]:
```
taxi = dd.read_csv('../Data/Chicago_taxi/chicago_taxi_trips_2016_01.csv
', dtype={'taxi_id': 'float64'})
```

In [25]:
```
taxi
```

Out[25]:

Dask DataFrame Structure:

	taxi_id	trip_start_timestamp	trip_end_timestamp	trip_seconds	trip_miles	picku
npartitions=3						
	float64	object	object	float64	float64	float6
	...	...	...	...	...	...
	...	...	...	...	...	...
	...	...	...	...	...	...

Dask Name: from-delayed, 9 tasks

We are working here on a trivial question and checking the relation between the fare and the trip time (in seconds). We only keep those two variables:

In [26]:
```
taxi = taxi[['trip_seconds', 'fare']]
```

In [27]:
```
taxi = taxi.dropna()
```

Then we can easily split out dataset into train and test sets:

In [28]:
```
train, test = taxi.random_split([0.8, 0.2])
```

We pick a linear regression model from dask_ml:

In [56]:
```
from dask_ml.linear_model import LinearRegression
```

We create a linear fit object as we would do it in scikit-learn:

In [30]:
```
linfit = LinearRegression(fit_intercept=False)
```

And we call the `fit()` method like for any other scikit-ml method:

In [57]:
```
linfit_model = linfit.fit(train[['trip_seconds']].values,train[['fare
']].values)
```

We can then predict values for our test set:

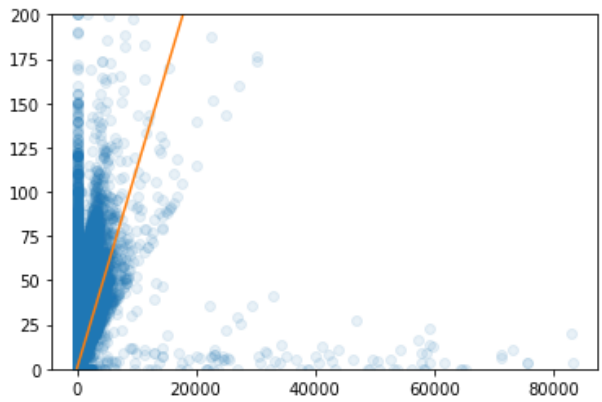
In [59]:
```
pred = linfit_model.predict(test[['trip_seconds']].values)
```

And we see that the model takes in dask object and also generates a dask object. Hence we can do prediction for large datasets! Finally we can look at our fit:

In [61]:
```
import matplotlib.pyplot as plt
import numpy as np

fig, ax = plt.subplots()
plt.plot(test.trip_seconds.compute().values, test.fare.compute().value
s,'o',alpha = 0.1)
plt.plot(np.arange(0,20000), linfit_model.coef_[0]*np.arange(0,20000))
ax.set_ylim([0,200])
```

Out[61]: (0, 200)



dask-image

We have seen before that we could wrap an image importer and other image processing functions into `delay()` calls. However Dask offers a built-in set of functions to deal with images. We are going to illistrate this through an example.

We load a series of images:

In [39]:
```
from dask_image import imread, ndfilters
import dask
```

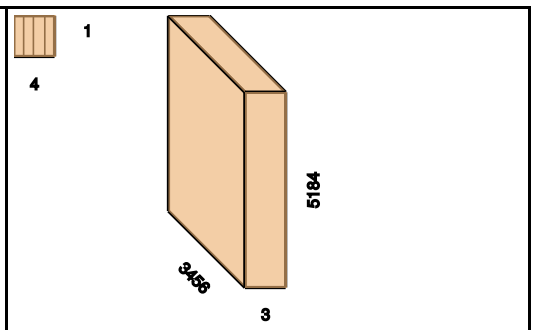
We have a series of images in a folder. We want to analyze all of them and create a large dask array:

In [57]:
```
images = imread.imread('/Users/gw18g940/OneDrive - Universitaet Bern/Cou
rses/DaskCourse/Butterflies/CAM01798*.JPG')
```

In [58]:
```
images
```

Out[58]:

	Array	Chunk
Bytes	214.99 MB	53.75 MB
Shape	(4, 3456, 5184, 3)	(1, 3456, 5184, 3)
Count	12 Tasks	4 Chunks
Type	uint8	numpy.ndarray



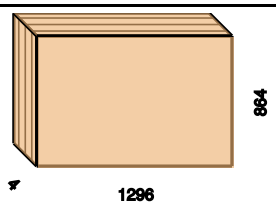
Then we only keep a single channel and downscale the image by slicing the array:

In [59]:
```
im_downscale = images[:,::4,::4,0]
```

In [61]:
```
im_downscale
```

Out[61]:

	Array	Chunk
Bytes	4.48 MB	1.12 MB
Shape	(4, 864, 1296)	(1, 864, 1296)
Count	16 Tasks	4 Chunks
Type	uint8	numpy.ndarray



Then we filter each image using a guassian filter implemented in dask-image:

In [62]:
```
im_filtered = ndfilters.gaussian_filter(im_downscale, sigma=(0,2,2))
```

We recover both the original and filtere image for comparison. Note that this is not something that one would typically do as it loads all data into RAM:

In [63]:
```
result = dask.compute(images, im_filtered)
```

In [64]:
```
import matplotlib.pyplot as plt

fig, ax = plt.subplots(2,1, figsize=(10,10))
ax[0].imshow(result[0][0,:,:],cmap = 'gray')
ax[1].imshow(result[1][0,:,:],cmap = 'gray')
```

Out[64]: <matplotlib.image.AxesImage at 0x12e305390>