Large Data in MATLAB: A Case Study in Seismic Data Processing

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These are the files used in the webinar on Feb. 23, 2011. This file provides a brief description of the contents of the demo files and the steps needed to download the public data sources for use with this demo. You can watch the archived version of this webinar at http://www.mathworks.com/webinars

Data Sources

Two sources of data are used.

The fault model is a slice from an SEG/EAGE model which was take from http://utam.gg.utah.edu/Inter.LAB1/CH2.lab/lab.mig.pre/lab.html. The velocity model is needed to run `faultModelMigration.m`.

The salt tooth model is from the BP Benchmark data set from: http://software.seg.org/datasets/2D/2004_BP_Vel_Benchmark

You will need to download the BP Benchmark files to run the `saltModelMigrationRTM.m` and `migrateExample.m` files.

Required Products and Hardware

MATLAB. You will also need Parallel Computing Toolbox and MATLAB Distributed Computing Server if you want to speed up computations using multiple MATLAB Workers (on a multicore desktop or across a cluster of computers) or run the GPU example. This demo was developed and tested on R2010b.

For the GPU examle, you will need a supported GPU. Consult http://www.mathworks.com/products/parallel-computing/requirements.html to determine if your hardware is supported.

Run `setup.m`

The script `setup.m` will create the directories needed and download the data from the public sources. It will also generate the 20GB traveltime.data file used once all the data has completed downloading. This can take several hours, depending upon your network connection and computer. It is recomended to run this script when you don't need your computer for several hours (or run overnight). Once this completes, you will be able to run the demos.

Parallel Computing Setup

`migrateExample.m` uses parallel computing to run the migration. If you don't use parallel computing, it will run for 2-3 days, or more if depending upon your machine. To set up parallel computing, consult the doc. You will also need to change the `matlabpool` call in `migrateExample.m` to point to your resources.

GPU Setup

You will need to compile the CUDA kernels (*.cu files in gpu directory). Assuming your system is configured correctly, you can run the `build.m` file to compile and test the kernels are working correctly.

Recommended Demo Order

To get the most out of this example. Run these demos in this order:

- `faultModelMigrationRTM.m`
- `migrateExample.m` migration with parallel computing>
- `saltModelMigrationRTM.m` salt model on GPU

Directory and File Listing

Listing of directories and files, post run of the demo files.

Top level directory (LargeDataSeismic)

```
dir
```

```
.                                html
..                               migrateExample.m
LargeDataSeismicWebinar.pdf      migration
LargeDataSeismicWebinar.pptx     saltModelMigrationRTM.m
README.asv                       saltToothModelData
README.m                         setup.asv
benchmark                        setup.m
faultModelData                   speedup.fig
faultModelMigrationRTM.m         videos
fileReader
gpu
```

Benchmark data directory

```
dir benchmark
```

```
.                                shots0601_0800.segy
..                               shots0801_1000.segy
README.pdf                       shots1001_1200.segy
```

```
README_Modification.txt      shots1201_1348.segy
central_shot_674.gif         travelTime.dat
eage_abstract.pdf            vel_6.25m.gif
shots0001_0200.segy          vel_z6.25m_x12.5m_exact.segy
shots0201_0400.segy
shots0401_0600.segy
```

faultModelData directory stores the intermediate results generated from `faultModelMigrationRTM.m`.

```
dir faultModelData
```

```
.                   rtmsnapshot77.mat   shotfdm56.mat       snapshot35.mat
..                  rtmsnapshot78.mat   shotfdm57.mat       snapshot36.mat
rtmsnapshot1.mat    rtmsnapshot79.mat   shotfdm58.mat       snapshot37.mat
rtmsnapshot10.mat   rtmsnapshot8.mat    shotfdm59.mat       snapshot38.mat
rtmsnapshot100.mat  rtmsnapshot80.mat   shotfdm6.mat        snapshot39.mat
rtmsnapshot11.mat   rtmsnapshot81.mat   shotfdm60.mat       snapshot4.mat
rtmsnapshot12.mat   rtmsnapshot82.mat   shotfdm61.mat       snapshot40.mat
rtmsnapshot13.mat   rtmsnapshot83.mat   shotfdm62.mat       snapshot41.mat
rtmsnapshot14.mat   rtmsnapshot84.mat   shotfdm63.mat       snapshot42.mat
rtmsnapshot15.mat   rtmsnapshot85.mat   shotfdm64.mat       snapshot43.mat
rtmsnapshot16.mat   rtmsnapshot86.mat   shotfdm65.mat       snapshot44.mat
rtmsnapshot17.mat   rtmsnapshot87.mat   shotfdm66.mat       snapshot45.mat
rtmsnapshot18.mat   rtmsnapshot88.mat   shotfdm67.mat       snapshot46.mat
rtmsnapshot19.mat   rtmsnapshot89.mat   shotfdm68.mat       snapshot47.mat
rtmsnapshot2.mat    rtmsnapshot9.mat    shotfdm69.mat       snapshot48.mat
rtmsnapshot20.mat   rtmsnapshot90.mat   shotfdm7.mat        snapshot49.mat
rtmsnapshot21.mat   rtmsnapshot91.mat   shotfdm70.mat       snapshot5.mat
rtmsnapshot22.mat   rtmsnapshot92.mat   shotfdm71.mat       snapshot50.mat
rtmsnapshot23.mat   rtmsnapshot93.mat   shotfdm72.mat       snapshot51.mat
rtmsnapshot24.mat   rtmsnapshot94.mat   shotfdm73.mat       snapshot52.mat
rtmsnapshot25.mat   rtmsnapshot95.mat   shotfdm74.mat       snapshot53.mat
rtmsnapshot26.mat   rtmsnapshot96.mat   shotfdm75.mat       snapshot54.mat
rtmsnapshot27.mat   rtmsnapshot97.mat   shotfdm76.mat       snapshot55.mat
rtmsnapshot28.mat   rtmsnapshot98.mat   shotfdm77.mat       snapshot56.mat
rtmsnapshot29.mat   rtmsnapshot99.mat   shotfdm78.mat       snapshot57.mat
rtmsnapshot3.mat    shotfdm1.mat        shotfdm79.mat       snapshot58.mat
rtmsnapshot30.mat   shotfdm10.mat       shotfdm8.mat        snapshot59.mat
rtmsnapshot31.mat   shotfdm100.mat      shotfdm80.mat       snapshot6.mat
rtmsnapshot32.mat   shotfdm11.mat       shotfdm81.mat       snapshot60.mat
rtmsnapshot33.mat   shotfdm12.mat       shotfdm82.mat       snapshot61.mat
rtmsnapshot34.mat   shotfdm13.mat       shotfdm83.mat       snapshot62.mat
rtmsnapshot35.mat   shotfdm14.mat       shotfdm84.mat       snapshot63.mat
rtmsnapshot36.mat   shotfdm15.mat       shotfdm85.mat       snapshot64.mat
rtmsnapshot37.mat   shotfdm16.mat       shotfdm86.mat       snapshot65.mat
rtmsnapshot38.mat   shotfdm17.mat       shotfdm87.mat       snapshot66.mat
rtmsnapshot39.mat   shotfdm18.mat       shotfdm88.mat       snapshot67.mat
rtmsnapshot4.mat    shotfdm19.mat       shotfdm89.mat       snapshot68.mat
rtmsnapshot40.mat   shotfdm2.mat        shotfdm9.mat        snapshot69.mat
rtmsnapshot41.mat   shotfdm20.mat       shotfdm90.mat       snapshot7.mat
rtmsnapshot42.mat   shotfdm21.mat       shotfdm91.mat       snapshot70.mat
rtmsnapshot43.mat   shotfdm22.mat       shotfdm92.mat       snapshot71.mat
```

```
rtmsnapshot44.mat   shotfdm23.mat       shotfdm93.mat       snapshot72.mat
rtmsnapshot45.mat   shotfdm24.mat       shotfdm94.mat       snapshot73.mat
rtmsnapshot46.mat   shotfdm25.mat       shotfdm95.mat       snapshot74.mat
rtmsnapshot47.mat   shotfdm26.mat       shotfdm96.mat       snapshot75.mat
rtmsnapshot48.mat   shotfdm27.mat       shotfdm97.mat       snapshot76.mat
rtmsnapshot49.mat   shotfdm28.mat       shotfdm98.mat       snapshot77.mat
rtmsnapshot5.mat    shotfdm29.mat       shotfdm99.mat       snapshot78.mat
rtmsnapshot50.mat   shotfdm3.mat        snapshot1.mat       snapshot79.mat
rtmsnapshot51.mat   shotfdm30.mat       snapshot10.mat      snapshot8.mat
rtmsnapshot52.mat   shotfdm31.mat       snapshot100.mat     snapshot80.mat
rtmsnapshot53.mat   shotfdm32.mat       snapshot11.mat      snapshot81.mat
rtmsnapshot54.mat   shotfdm33.mat       snapshot12.mat      snapshot82.mat
rtmsnapshot55.mat   shotfdm34.mat       snapshot13.mat      snapshot83.mat
rtmsnapshot56.mat   shotfdm35.mat       snapshot14.mat      snapshot84.mat
rtmsnapshot57.mat   shotfdm36.mat       snapshot15.mat      snapshot85.mat
rtmsnapshot58.mat   shotfdm37.mat       snapshot16.mat      snapshot86.mat
rtmsnapshot59.mat   shotfdm38.mat       snapshot17.mat      snapshot87.mat
rtmsnapshot6.mat    shotfdm39.mat       snapshot18.mat      snapshot88.mat
rtmsnapshot60.mat   shotfdm4.mat        snapshot19.mat      snapshot89.mat
rtmsnapshot61.mat   shotfdm40.mat       snapshot2.mat       snapshot9.mat
rtmsnapshot62.mat   shotfdm41.mat       snapshot20.mat      snapshot90.mat
rtmsnapshot63.mat   shotfdm42.mat       snapshot21.mat      snapshot91.mat
rtmsnapshot64.mat   shotfdm43.mat       snapshot22.mat      snapshot92.mat
rtmsnapshot65.mat   shotfdm44.mat       snapshot23.mat      snapshot93.mat
rtmsnapshot66.mat   shotfdm45.mat       snapshot24.mat      snapshot94.mat
rtmsnapshot67.mat   shotfdm46.mat       snapshot25.mat      snapshot95.mat
rtmsnapshot68.mat   shotfdm47.mat       snapshot26.mat      snapshot96.mat
rtmsnapshot69.mat   shotfdm48.mat       snapshot27.mat      snapshot97.mat
rtmsnapshot7.mat    shotfdm49.mat       snapshot28.mat      snapshot98.mat
rtmsnapshot70.mat   shotfdm5.mat        snapshot29.mat      snapshot99.mat
rtmsnapshot71.mat   shotfdm50.mat       snapshot3.mat       travelTime.mat
rtmsnapshot72.mat   shotfdm51.mat       snapshot30.mat      velocityModel.
rtmsnapshot73.mat   shotfdm52.mat       snapshot31.mat
rtmsnapshot74.mat   shotfdm53.mat       snapshot32.mat
rtmsnapshot75.mat   shotfdm54.mat       snapshot33.mat
rtmsnapshot76.mat   shotfdm55.mat       snapshot34.mat
```

fileReader directory contains the SEG Y file reader object used to read SEGY files in benchmark folder. Note that these fileReaders have not been fully tested against SEGY/SEGD/SEG2 specifications. No gurantees are provided that they work on all SEGx formatted files.

```
dir fileReader
```

```
.                   SegYFileReader.m    ibm2ieee.m
..                  SegyMemmap.m        travelTimeMemmap.m
Seg2FileReader.m    SeismicFileReader.m
```

gpu directory contains the files used to speed up computations usin a GPU.

```
dir gpu
```

```
.                 dat4gpu.mat       fm2d_kernel.ptx   rtm2d_kernel.ptx
..                fm2d_gpu.m        rtm2d_gpu.m
build.m           fm2d_kernel.cu    rtm2d_kernel.cu
```

Migration routines and utillity functions

```
dir migration
```

```
.                 migrate.m           rtm2d.m
..                plotProgress.m      seismic.m
dA.mat            ray2d.m             shot2RecTime.m
fm2d.m            ricker.m            shotRecordLocator.m
```

saltToothModelData directory stores intermediate results generated from `saltModelMigrationRTM.m`.

```
dir saltToothModelData
```

```
.               shotfdm18.mat   shotfdm6.mat    snapshot16.mat  snapshot4.
..              shotfdm19.mat   shotfdm7.mat    snapshot17.mat  snapshot5.
shotfdm1.mat    shotfdm2.mat    shotfdm8.mat    snapshot18.mat  snapshot6.
shotfdm10.mat   shotfdm20.mat   shotfdm9.mat    snapshot19.mat  snapshot7.
shotfdm11.mat   shotfdm21.mat   snapshot1.mat   snapshot2.mat   snapshot8.
shotfdm12.mat   shotfdm22.mat   snapshot10.mat  snapshot20.mat  snapshot9.
shotfdm13.mat   shotfdm23.mat   snapshot11.mat  snapshot21.mat  travelTime
shotfdm14.mat   shotfdm24.mat   snapshot12.mat  snapshot22.mat
shotfdm15.mat   shotfdm3.mat    snapshot13.mat  snapshot23.mat
shotfdm16.mat   shotfdm4.mat    snapshot14.mat  snapshot24.mat
shotfdm17.mat   shotfdm5.mat    snapshot15.mat  snapshot3.mat
```

videos contains videos generated from results

```
dir videos
```

```
.                           migrationAnimation.avi
..                          saltToothMigrationKirchhoff.avi
FaultModelKirchhoff.avi     saltToothMigrationRTM.avi
FaultModelKirchhoffBone.avi saltToothModelShots.avi
FaultModelRTM.avi           seismicSurveyAnimation.mp4
FaultModelRTMBone.avi       velocityShotAnimation.avi
FaultModelShots.avi
FaultModelTravelTime.avi
```

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