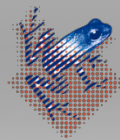




Modelling Movement Disorders on the Virtual Research Environment

15-10-2019

Ioannis Giotis



umcg

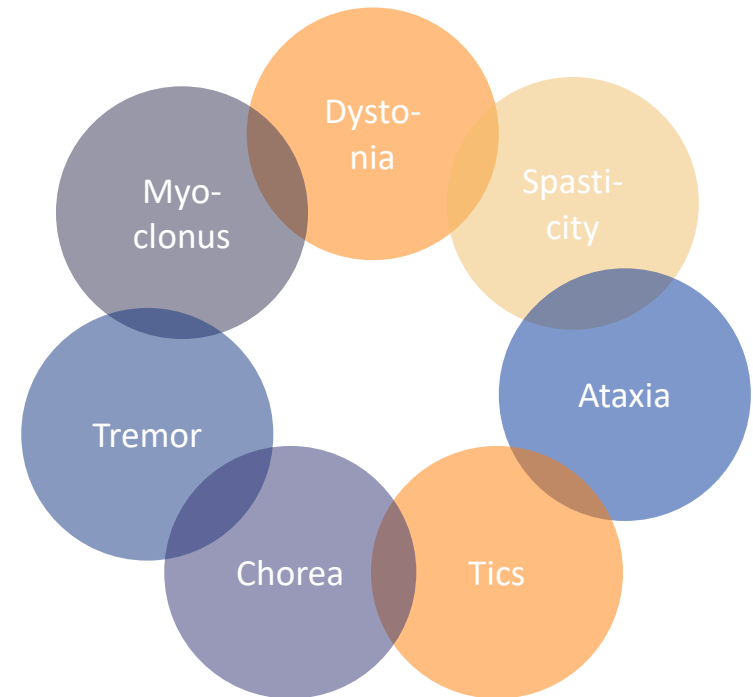


Research Institute
BCN-BRAIN

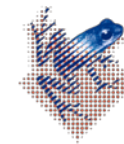
provinsje fryslân
provincie fryslân 

Hyperkinetic Movement Disorders

- **Clinical presentation**
 - **Complex**
 - **Mixed**
 - **Functional**
- **Classification = expert opinion**
- **Large inter- and intra-observer variability**
- **Major problems:**
 - **Diagnosis**
 - **Tailored treatment**
 - **Evaluation of treatment effect**



- Goal 1: To develop novel and integrated methods to phenotype involuntary movements using
 - 3D video cameras;
 - motion sensors;
 - muscle electrodes.
- Goal 2: To develop a computer aided diagnostic tool to classify hyperkinetic movement disorders



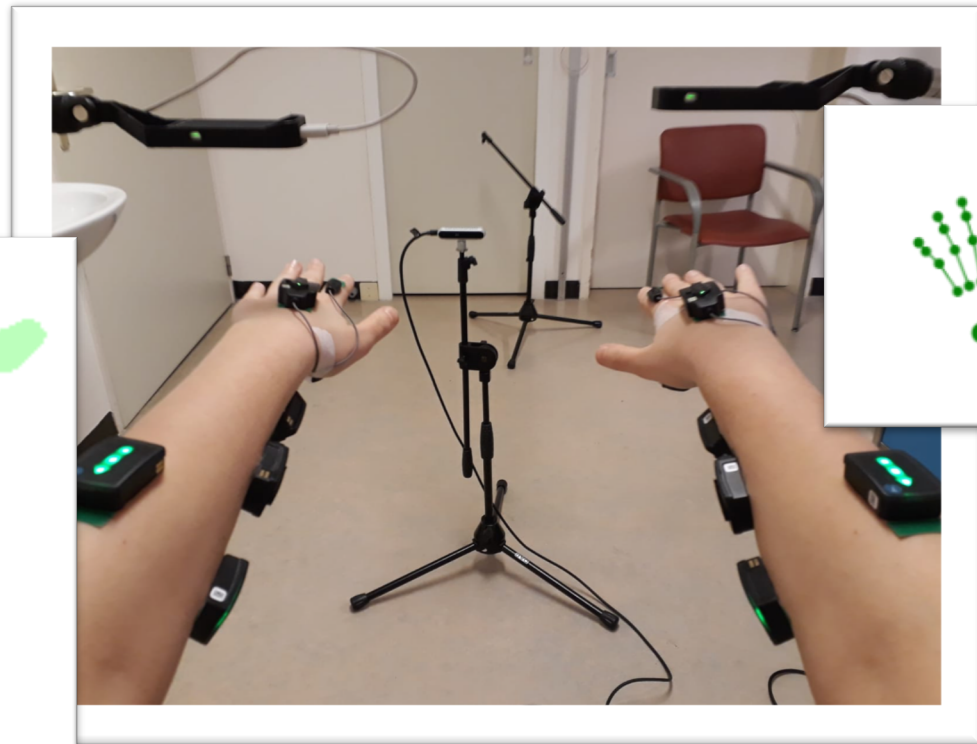
umcg

ZIUS.
visual intelligence



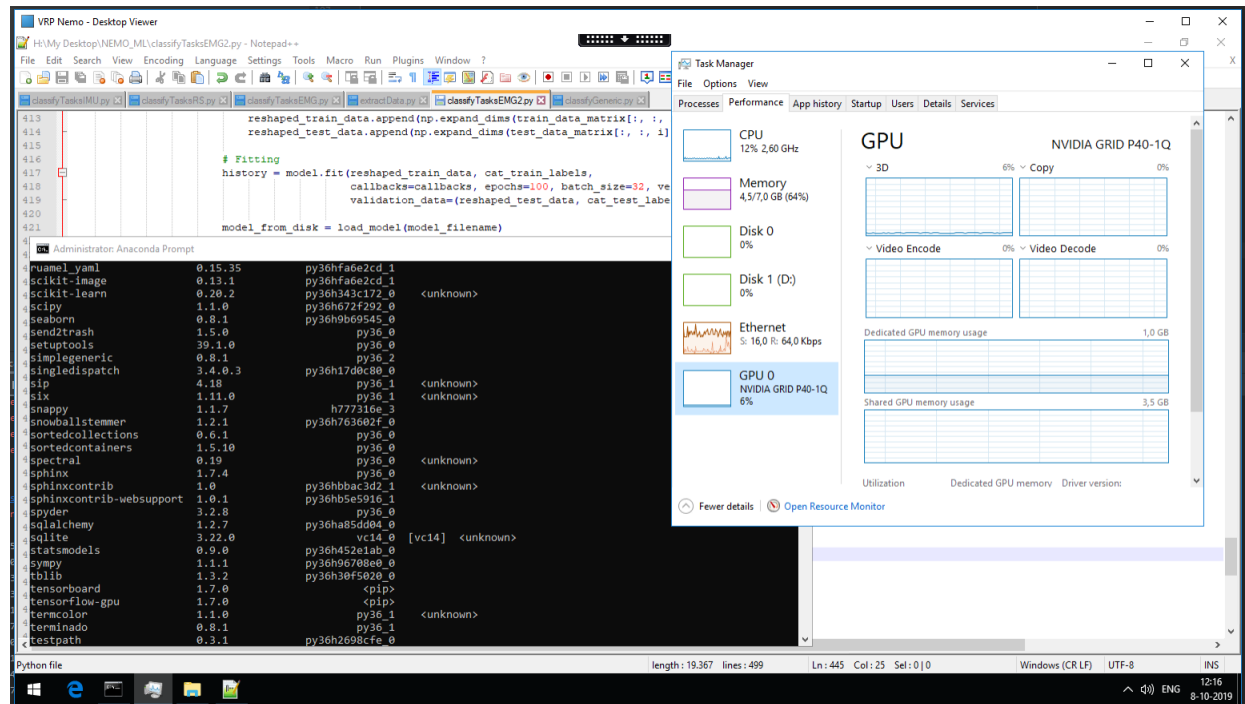
NEMO: data modalities

- 3D video cameras;
- motion sensors;
- muscle electrodes.



Virtual Research Workspace

- Intel Xeon CPUs / 8 GB RAM
- GPU processing capabilities;
- Python 3 + Data analytics / Machine learning libs
- SFTP



The screenshot displays a virtual desktop environment. The main window is a code editor (Notepad++) showing Python code for data processing and machine learning. Below the code editor is a terminal window displaying the output of a command, listing installed packages and their versions.

Code Editor (Notepad++):

```

413 reshaped_train_data.append(np.expand_dims(train_data_matrix[:, :, 1],
414                                     axis=0))
415 reshaped_test_data.append(np.expand_dims(test_data_matrix[:, :, 1],
416                                     axis=0))
417
418 # Fitting
419 history = model.fit(reshaped_train_data, cat_train_labels,
420                     callbacks=callbacks, epochs=100, batch_size=32, validation_data=(reshaped_test_data, cat_test_labels))
421 model_from_disk = load_model(model_filename)
  
```

Terminal (Administrator: Anaconda Prompt):

```

C:\Users\user>pip freeze
pymc3==2.15.35 py36hfa6e2cd_1
scikit-image==0.13.1 py36hfa6e2cd_1
scikit-learn==0.20.2 py36h343c172_0
scipy==1.1.0 py36h72f292_0
seaborn==0.8.1 py36h9b6e545_0
send2trash==1.5.0 py36_0
setuptools==39.1.0 py36_2
simplegeneric==0.8.1 py36_2
singledispatch==3.4.0.3 py36_1
six==1.11.0 py36_1
snappy==1.1.7 h777310e_3
snowballstemmer==1.2.1 py36h763602f_0
sortedcollections==0.6.1 py36_0
sortedcontainers==1.5.10 py36_0
spectral==0.19 py36_0
sphinx==1.7.4 py36_0
sphinxcontrib==1.0 py36hbbac3d2_1
sphinxcontrib-websupport==1.0.1 py36h5e5916_1
spyder==3.2.8 py36_0
sqlalchemy==1.2.7 py36ha85dd04_0
sqlite==3.22.0 vc14 [vc14] <unknown>
statsmodels==0.9.0 py36h452e1ab_0
sympy==1.1.1 py36h96708e0_0
tqdm==4.12.2 py36h30f5080_0
tensorboard==1.7.0 <pip>
tensorflow-gpu==1.7.0 <pip>
termcolor==1.1.0 py36_1
terminado==0.8.1 py36_1
testpath==0.3.1 py36h2698cfe_0
  
```

Task Manager (Performance Tab):

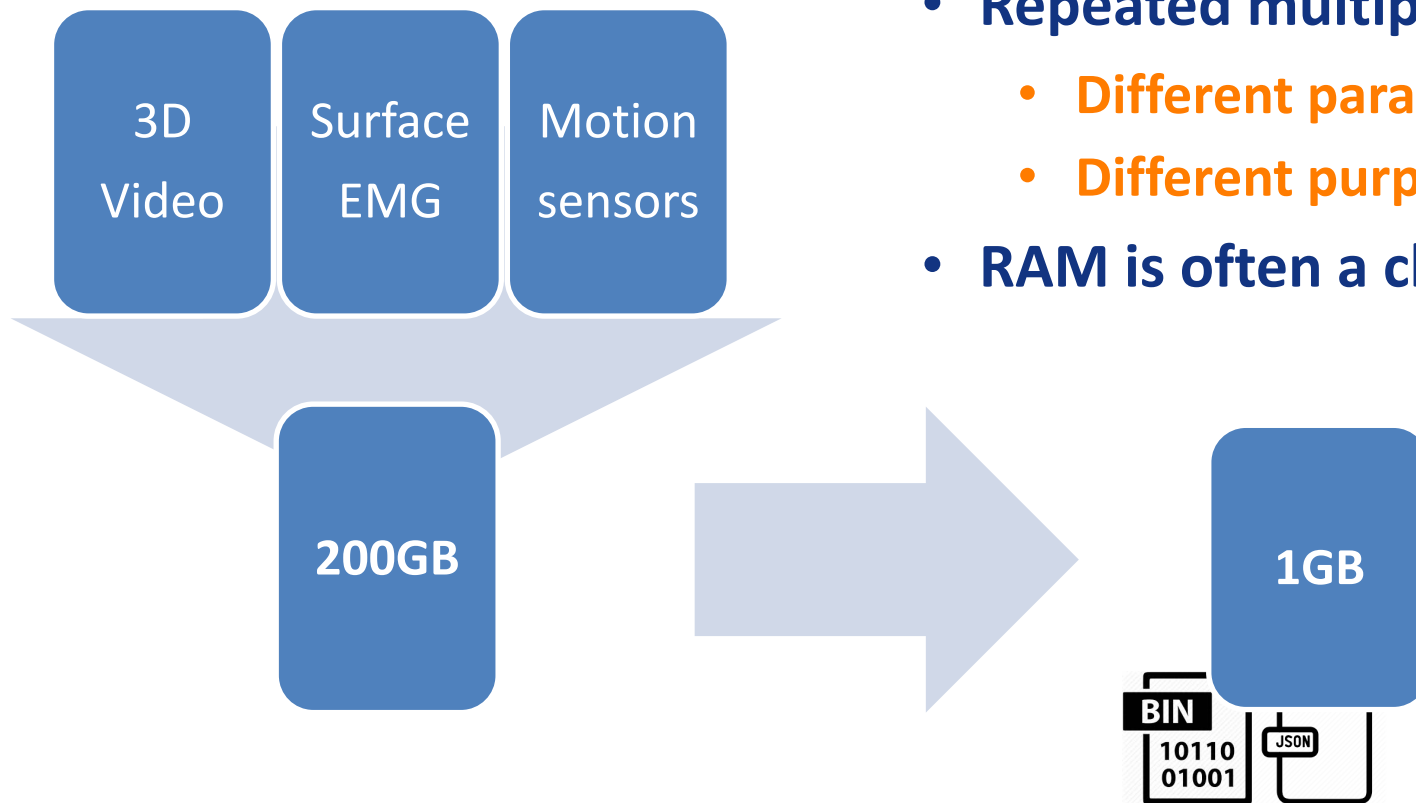
- CPU:** 12% 2.60 GHz
- Memory:** 4.5/7.0 GB (64%)
- Disk 0:** 0%
- Disk 1 (D:):** 0%
- Ethernet:** 16.0 B/s 64.0 Kbps
- GPU 0:** NVIDIA GRID P40-1Q 6%

GPU Details (NVIDIA GRID P40-1Q):

- 3D:** 6% Copy
- Video Encode:** 0% Video Decode: 0%
- Dedicated GPU memory usage:** 1.0 GB
- Shared GPU memory usage:** 3.5 GB

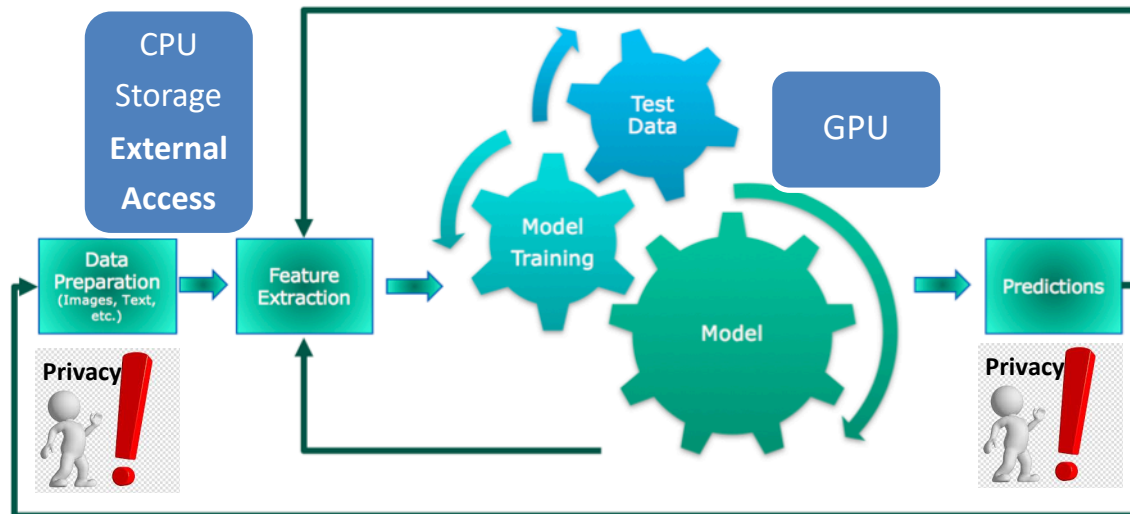
System Information: Windows (CR LF) UTF-8 INS 12:16 8-10-2019

Feature extraction from patient data



Building a Machine Learning pipeline

A Standard Machine Learning Pipeline



Security vs Usability

- **VRW roles and rights set a strict but clear security framework**
 - Federated account - separate project environments
 - Multifactor authentication via mobile phone
 - Upload - no download
- **Challenges**
 - No easy access for users outside the organisation
 - Updating data analysis environment inefficient
 - No internet access -> no online resources on the fly



Outlook

- **More self-management**
 - Data sharing
 - Configuration of tools and apps
- **More connectivity**
 - (Limited) internet access
- **More project management**
 - Planning
 - Shared documents / version control
 - Tasklists / workflows
- **...more processing power**

