



Modelling Movement Disorders on the Virtual Research Environment

15-10-2019

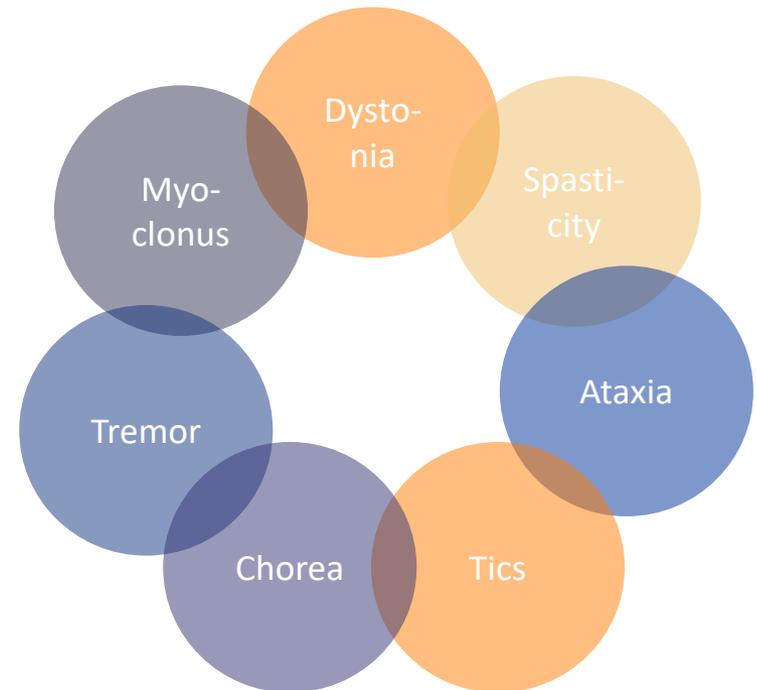
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Hyperkinetic Movement Disorders

- **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

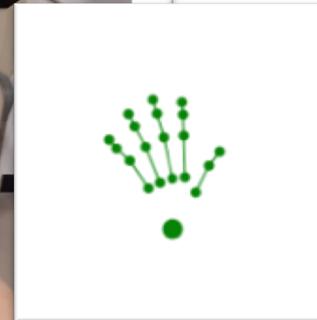
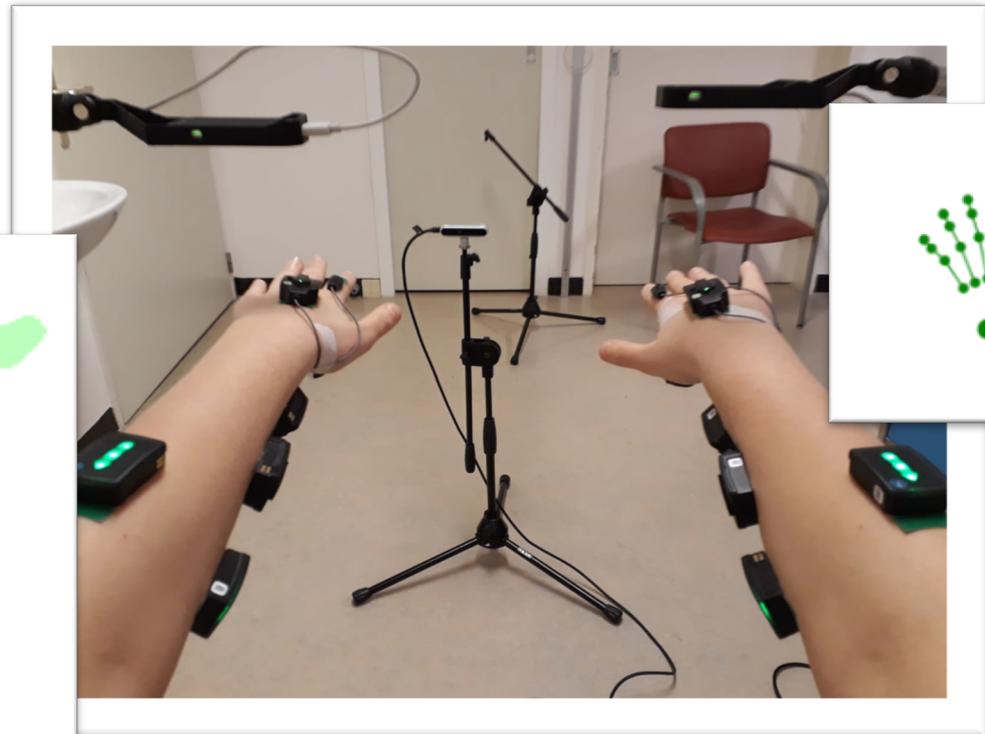
ZIUS.
visual intelligence





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 Notepad++ editor showing a Python script for data classification. Below the editor is a terminal window listing installed packages. To the right, a Task Manager window shows system performance metrics for CPU, Memory, Disk, Ethernet, and GPU.

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

Administrator: Anaconda Prompt

ruamel_yaml	0.15.35	py36hf46e2cd_1
scikit-image	0.13.1	py36hf46e2cd_1
scikit-learn	0.20.2	py36h343c172_0 <unknown>
scipy	1.1.0	py36h72f292_0
seaborn	0.8.1	py36h9b69545_0
send2trash	1.5.0	py36_0
setuptools	39.1.0	py36_0
simplegeneric	0.8.1	py36_2
singledispatch	3.4.0.3	py36h17d0c80_0
sip	4.18	py36_1
six	1.11.0	py36_1 <unknown>
snappy	1.1.7	h777310e_3 <unknown>
snoballstemmer	1.2.1	py36h763602f_0
sortedcollections	0.6.1	py36_0
sortedcontainers	1.5.10	py36_0
spectral	0.19	py36_0 <unknown>
sphinx	1.7.4	py36_0
sphinxcontrib	1.0	py36hb3ac3d2_1 <unknown>
sphinxcontrib-websupport	1.0.1	py36hb5e5916_1
spyder	3.2.0	py36_0
sqlalchemy	1.2.7	py36ha85d804_0
sqlite	3.22.0	vc14_0 [vc14] <unknown>
statsmodels	0.9.0	py36h452e1ab_0
sympy	1.1.1	py36h96708e0_0
tablib	1.3.2	py36h30f5090_0
tensorboard	1.7.0	<pip>
tensorflow-gpu	1.7.0	<pip>
termcolor	1.1.0	py36_1 <unknown>
terminado	0.8.1	py36_1
testpath	0.3.1	py36h2690cfe_0

Task Manager Performance View

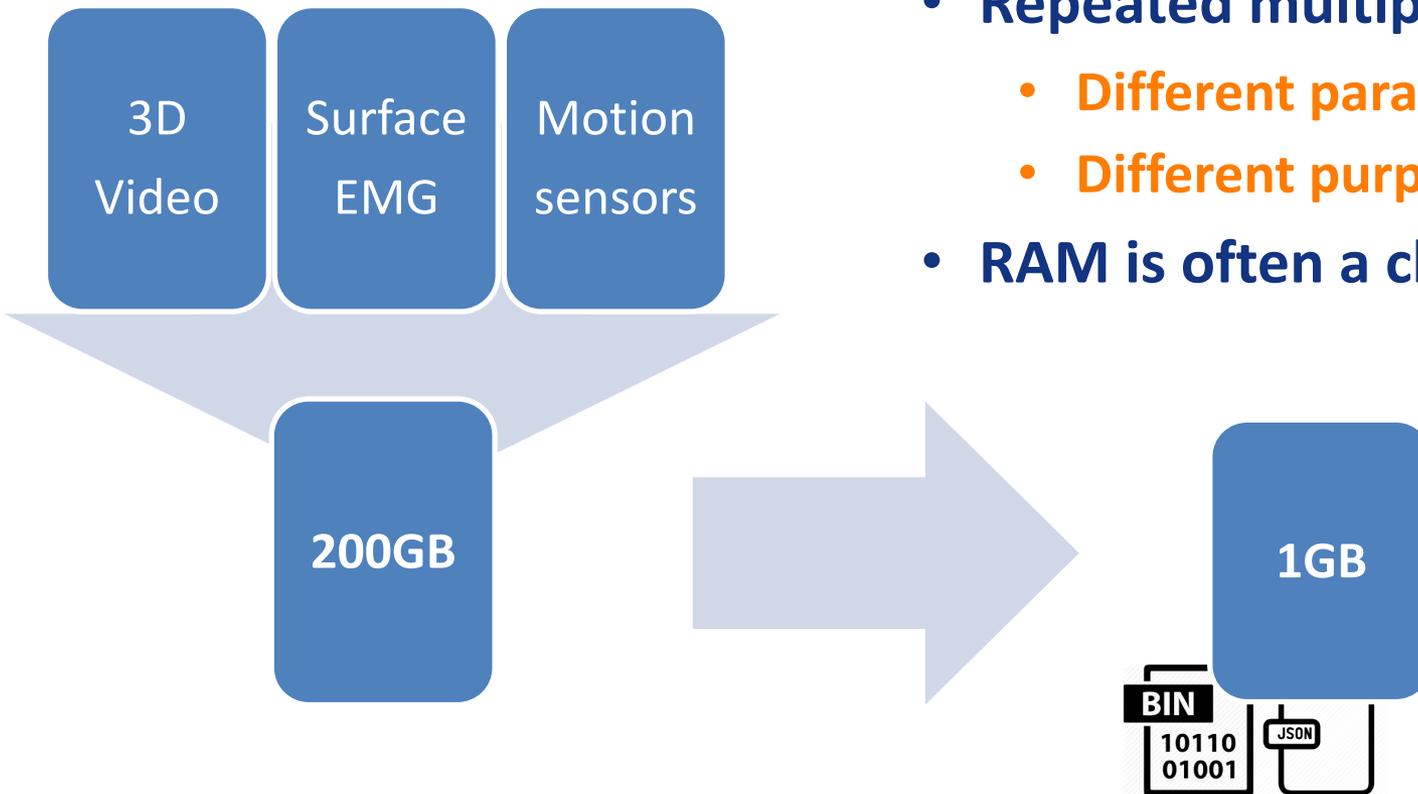
- CPU: 12% 2.60 GHz
- Memory: 4.5/7.0 GB (64%)
- Disk 0: 0%
- Disk 1 (D:): 0%
- Ethernet: 16.0 R: 64.0 Kbps
- GPU 0: NVIDIA GRID P40-1Q, 6% utilization

GPU Details: NVIDIA GRID P40-1Q, 6% utilization, Dedicated GPU memory usage: 1.0 GB, Shared GPU memory usage: 3.5 GB





Feature extraction from patient data

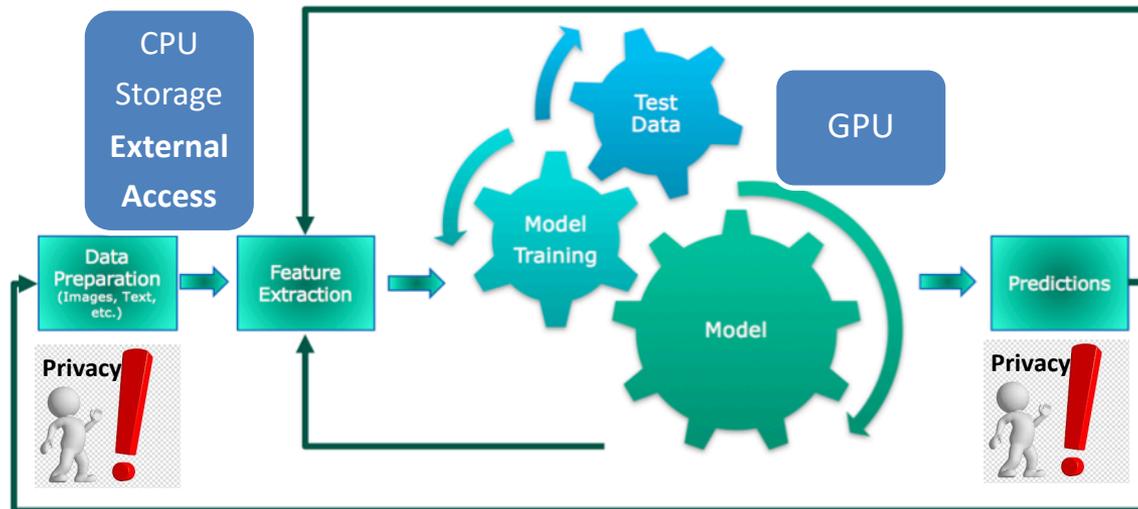


- Repeated multiple times
 - Different parameters
 - Different purposes
- RAM is often a challenge



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**

