

Introduction
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vLUME paper
oooooo

Deep Learning
oooooooooooo

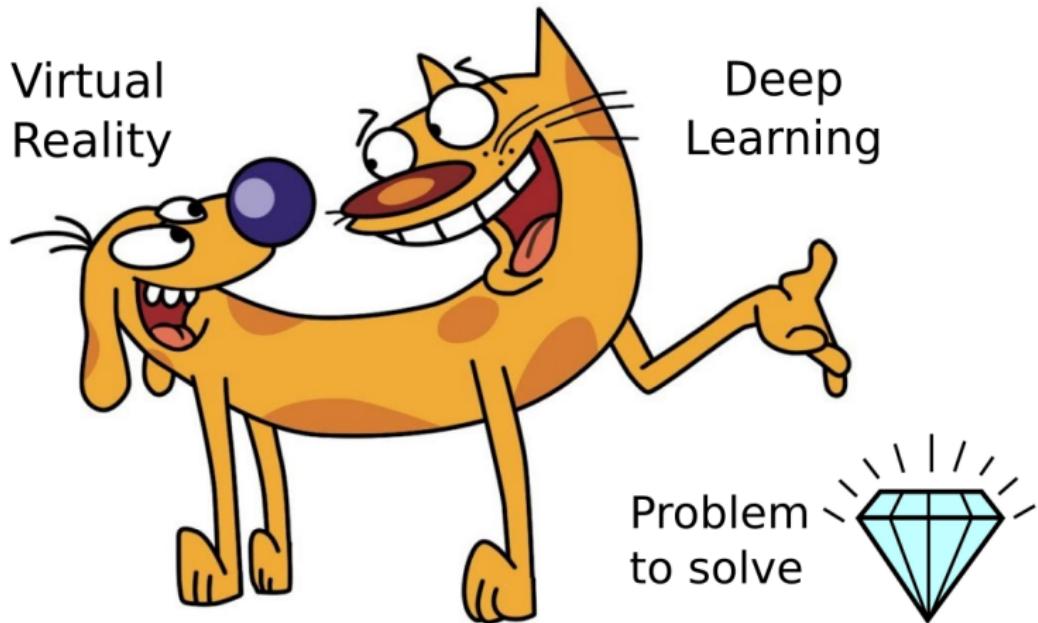
Discussion
o

vLUME paper + Deep Learning ... and why you may care

Anton Popov

ViRe / IJC

14/12/2020



Introduction



vLUME paper



Deep Learning



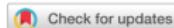
Discussion



nature | **methods**

BRIEF COMMUNICATION

<https://doi.org/10.1038/s41592-020-0962-1>



vLUME: 3D virtual reality for single-molecule localization microscopy

by Daniel Esteban-Ferrer *et al.*

Definition



Virtual reality (VR)

the use of computer modeling and simulation that enables a person to interact with an artificial three-dimensional (3-D) visual or other sensory environment.

But why?

Human spatial perception is fundamentally 3D.

Introduction



vLUME paper



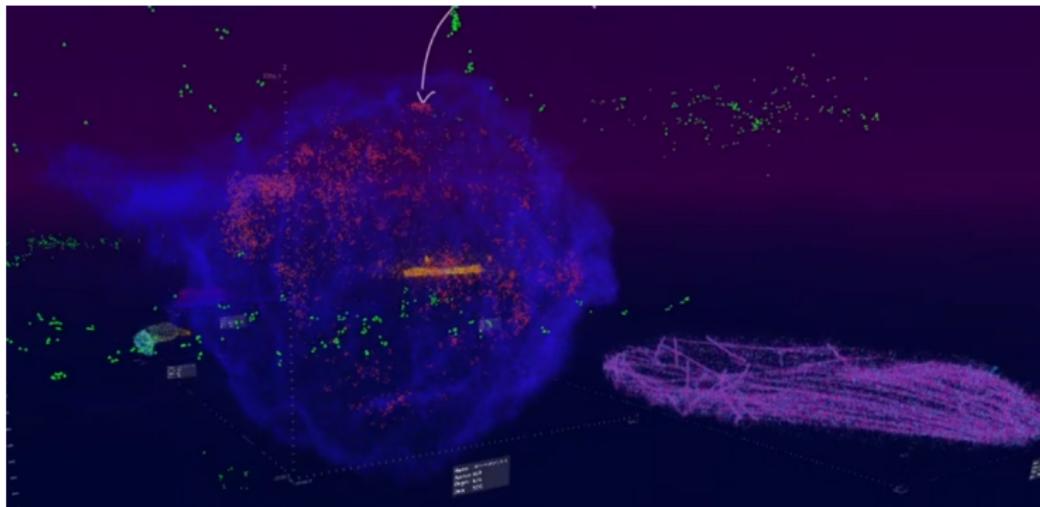
Deep Learning



Discussion



Demo



vLUME's key features

1. Data exploration and comparison
2. 3D regions of interest extraction (ROI); annotation, segmentation
3. Custom analysis of user-defined subregions
4. Export of video files for presentations / publications

Conclusions



Pros:

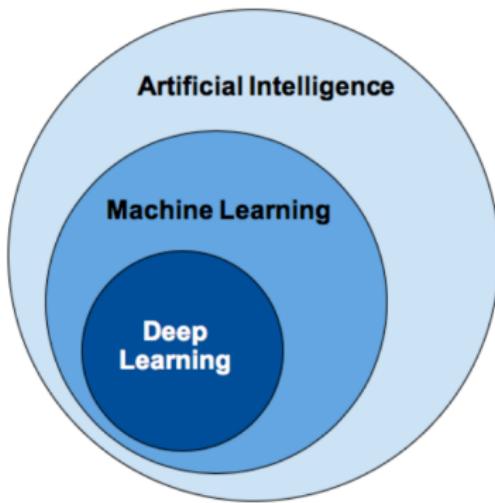
- ▶ Daniel have gotten experience of standard Unity engine utilization for VR tasks and became familiar with pitfalls to avoid

Cons:

- ▶ No source code available!

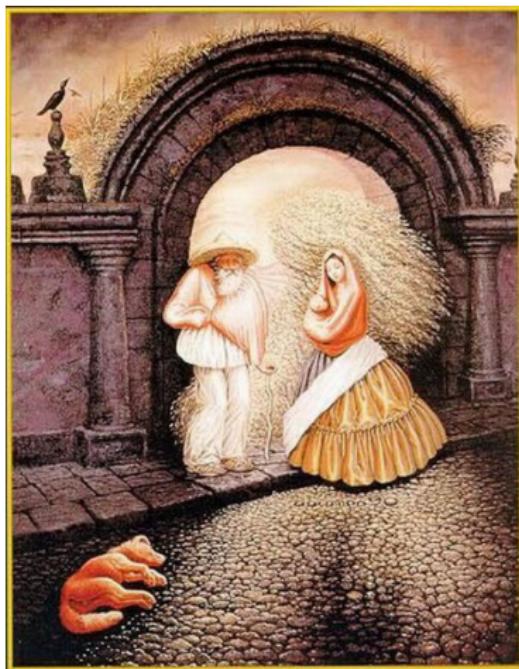
The first step was done! We start from the scratch now and have more options to adjust the future system to your needs!

What is Deep Learning?



- ▶ AI - mimics human behaviour;
- ▶ ML - use statistical methods to improve machines performance with experience;
- ▶ DL - use neural networks; *creates features on its own.*

Why Deep Learning if Random Forest works fine for us?



There are different approaches:

- ▶ Linear Models (Logistic regression, SVM);
- ▶ **Tree Based Methods (i. e. Random Forest);**
- ▶ **Deep Learning (Neural Networks);**
- ▶ kNN.

All of them has benefits and drawbacks, more suitable for different tasks and data (no free lunch theorem).

Computer vision: images are numbers

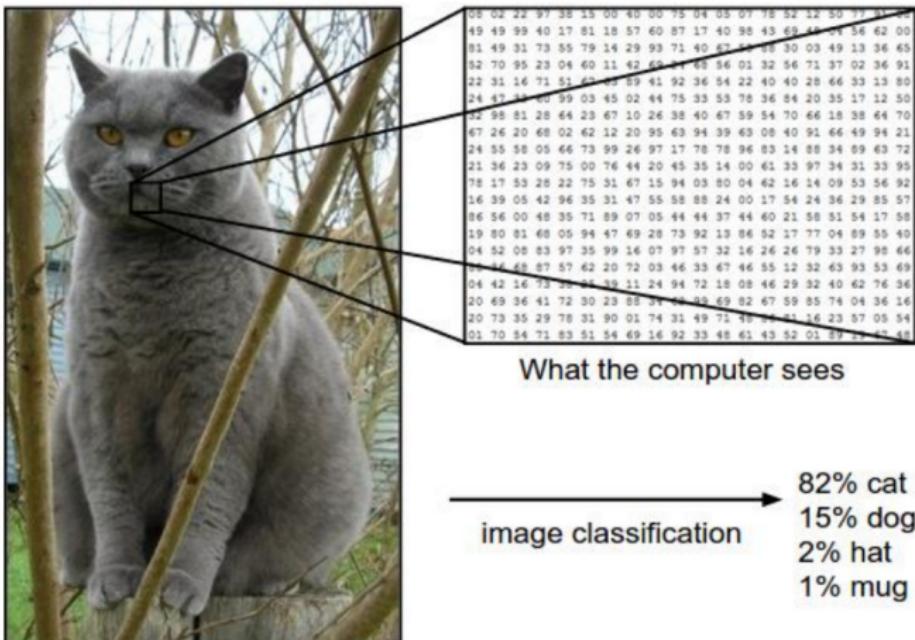
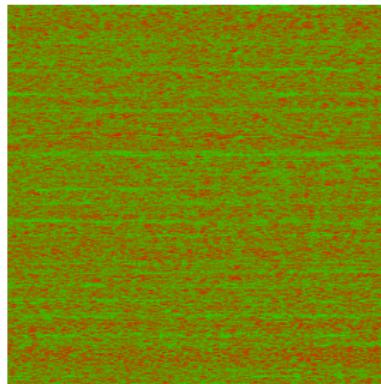


Figure: [MIT 6.S094](#)

IJC: Methilation data classifier

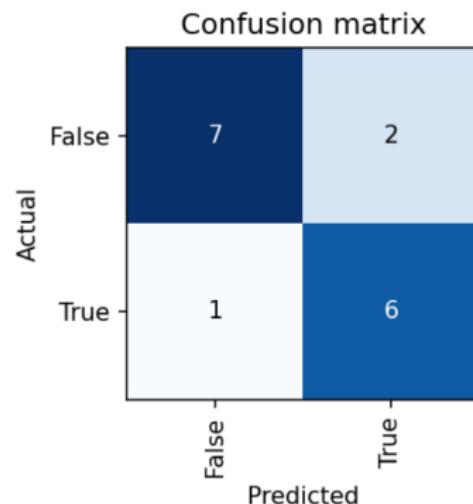
Step 1:

Convert interrogated cpg for patient:
[0.92, 0.77, 0.81, ..., 0.09, 0.62] to
the image:



Step 2:

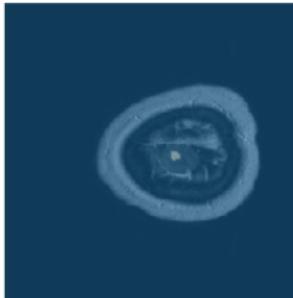
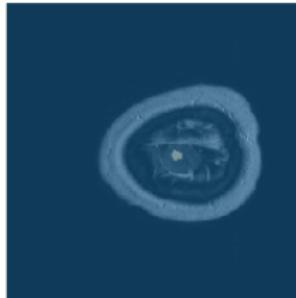
Build image classifier, results:



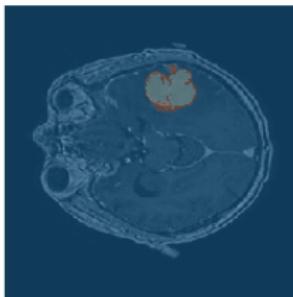
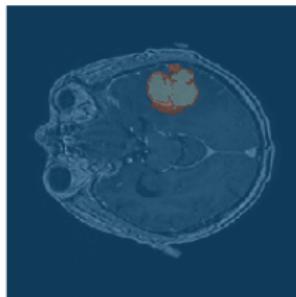
Resume: preliminary result provided by neural networks perform as classical ML approaches (and provide higher accuracy than in the [paper](#)).

MoLAB: MRI segmentation

Ground truth/Predictions



Data quality and quantity defines quality of results.
Labelled data is required.



Type	# of MRIs
Meningioma	276
HGG	528
Metastasis	264
Total	1068

MoLAB: MRI classification & interpretability

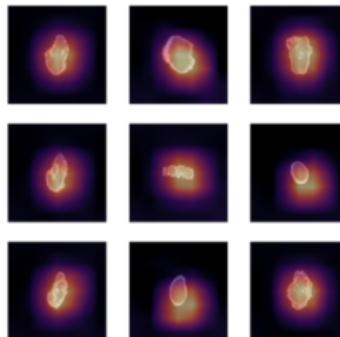
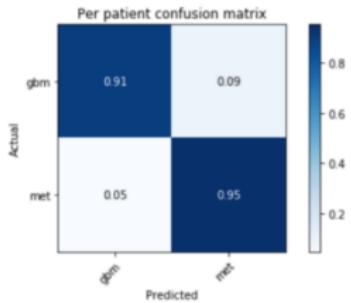
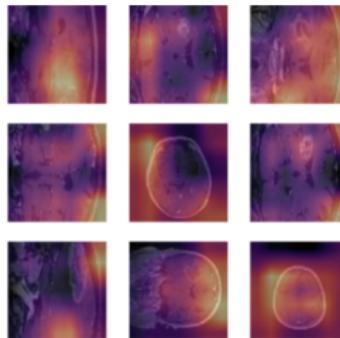
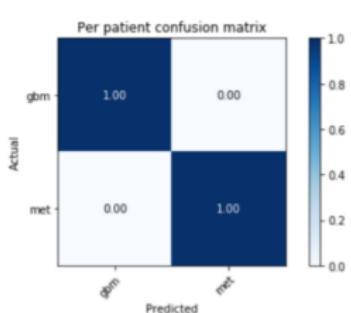
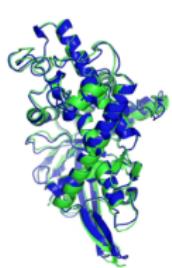


Figure: Qualification of DL-engineer is more important than data.

Deep Learning applications

Deep Learning solved protein folding problem.



T1037 / 6vr4
90.7 GDT
(RNA polymerase domain)



T1049 / 6y4f
93.3 GDT
(adhesin tip)

- Experimental result
- Computational prediction

Figure: [DeepMind blog post](#)

Synthetic MRI generation.

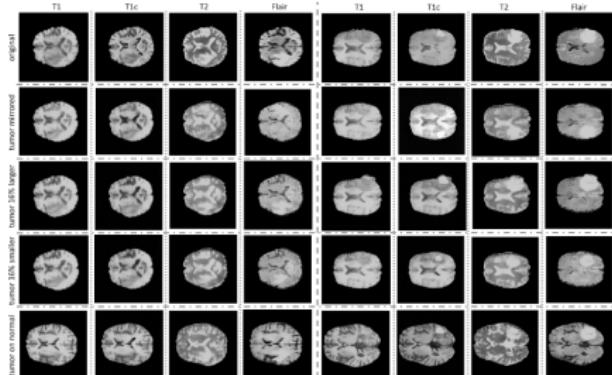


Figure: [NVidia blog post](#)

Deep Learning applications

A GPT-3 bot posted comments on Reddit for a week and no one noticed

Under the username /u/thegentlemetre, the bot was interacting with people on /r/AskReddit, a popular forum for general chat with 30 million users.

Figure: [Blog post](#)

GPT-3 model: [paper](#)

Navier–Stokes equations - important hydrodynamics model.

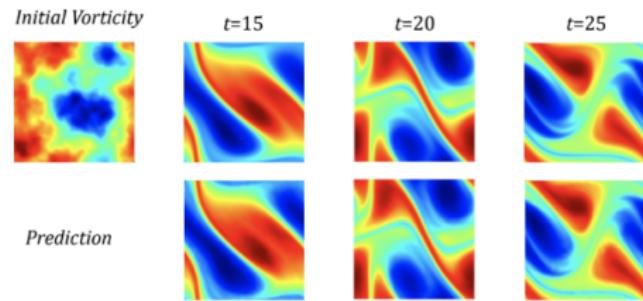
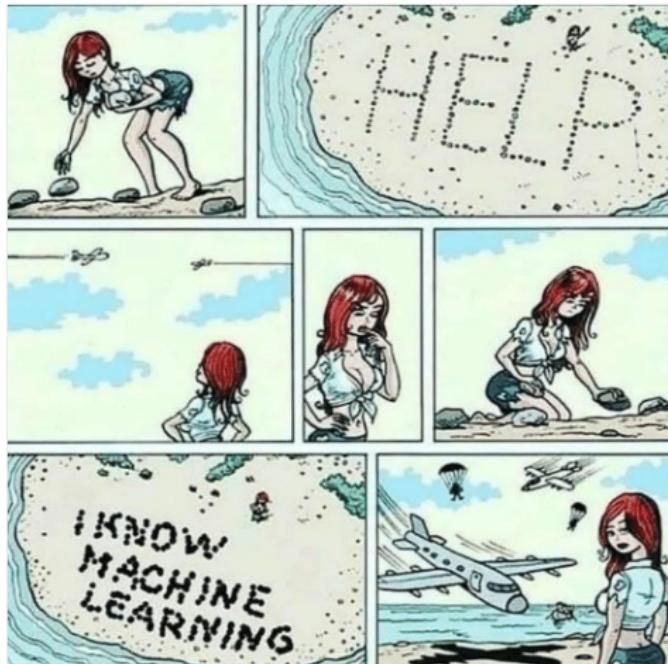


Figure: [Navier-Stokes equation solver \$10^3\$ speed-up](#)

Conclusions



- ▶ Deep Learning is valuable addition to IJC's tools-set ("AGATA" project?);
- ▶ Classical ML is still "the thing";
- ▶ I am happy to share my DL knowledge and expertise

Discussion



- ▶ Most of AI startups fail not because they have bad ML-models... but because they solve not relevant problems.
- ▶ What problems in your everyday work may be solved with the help of VR or DL or their combination?

Thank you for your attention!