TOON WEYENS

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Passionate about mathematics, science, technology and shaping the future. Trained as a Ph.D. in applied physics, followed by two years of research in nuclear fusion as the energy source of the future at the ITER Organization through the Monaco postdoctoral fellowship. Well-versed in computer science with extensive experience in Fortran, python, HPC parallel computing, git, vim, scientific visualization, among others. Enjoing mathematical excursions in domains such as partial differential equations, linear algebra, graph theory, neural networks. Inquisitive and analytical. Currently looking for exciting new challenges in the fields of data science and artificial intelligence.

Nationality: Belgian
Date of birth: 30/12/1987

EXPERIENCE

Jan '17 - Current **Postdoctoral Monaco Fellow**

ITER Organization

Responsible for the investigation of 3-D effects on Edge-Localized Modes (ELM) stability at the ITER Organization, a multi-billion dolar project where the world's most advanced nuclear fusion research reactor is being built. Using the numerical code PB3D, developed as part of my Ph.D. project. Have a look at the PB3D project below.

Jan '12 - Dec '16 **Doctoral Researcher**

Universidad Carlos III de Madrid · Eindhoven University of Technology · ITER Organization

Designed a research project dedicated to furthering the understanding of an important class of instabilities that occur in toroidal magnetic confinement devices for nuclear fusion, called *high-n* instabilities. A dedicated mathematical theory was developed [Weyens et al, 2014, P.o.P, 21, 4] and an optimized numerical code designed, PB3D [Weyens et al, 2017, J.c.P, 330], in Fortran, making use of modern High-Performance parallel computing (HPC) techniques.

EDUCATION

Sep '10 - Aug '12 **Master of Science - Nuclear Fusion Science & Technology**

Ghent University · Universidad Carlos III de Madrid · Université de Lorraine

European program in the Erasmus Mundus framework.

Graduated top 5%.

Sep '08 - Aug '10 **Master of Science - Energy Engineering**

University of Leuven · Technische Universität Berlin (exchange)

Curriculum included mostly scientific but also economic and managerial aspects of energy.

Graduated top 15%.

July '18 **Online Course - Introduction to Deep Learning** (part of Advanced Machine Learning)

Coursera advanced, by Higher School of Economics Moscow

Basic understanding of modern neural networks and their applications in computer vision and natural language understanding. Recap of linear models and discussion of stochastic optimization methods that are crucial for training deep neural networks. Treats all popular building blocks of neural networks including fully connected layers, convolutional and recurrent layers. Application of these building blocks to define complex modern architectures in TensorFlow and Keras frameworks.

Workload: 60 hours

certificate: link

May '18 **Online Specialization - Deep Learning**

Coursera intermediate, by Andrew Ng

The topics include the foundations of Deep Learning, understand how to build neural networks, and learn how to lead successful machine learning projects. Neural network techniques such as convolutional networks, RNNs, LSTM, Adam, Dropout, BatchNorm, Xavier/He initialization, and more are treated. There is a focus on case studies from healthcare, autonomous driving, sign language reading, music generation, and natural language processing. These ideas are practiced in Python, and use is made of software packages TensorFlow as well as Keras.

workload: 80-120 hours

certificate: link

May '14 **Summer School - 23rd Summer School on Parallel Computing**

CINECA, Casalecchio Di Reno

The Summer School on Parallel Computing is an intense, 10 day, graduate level course in HPC, with the objective of providing the participants with the skills to program and exploit modern parallel computing systems to solve computational problems. The school covers key topics focusing on HPC lexicon, parallel architectures, parallel programming models and methods, software engineering, profilers and debuggers.

workload: 100 hours

PROJECTS

Jan '13 - Current **PB3D**

Peeling-Ballooning in 3-D

PB3D (**P**eeling-**B**allooning in **3**-**D**} is a numerical code developed during as part of my doctoral research project. It is capable of analyzing in an efficient manner the peeling-ballooning stability of toroidal magnetic confinement devices for nuclear fusion. These so-called high-n instabilities are of importance in thee next generation of devices as they are easily excited and have the potential to couple plasma from the hot interior to the cold reactor walls. PB3D is unique in that it is geared towards these high-n instabilities, in general 3-D configurations, while allowing for the plasma edge to be perturbed [Weyens et al, 2017, J.c.P, 330].

For my postdoctoral research I currently emply PB3D to investigate certain 3-D effects, such as the usage of resonant magnetic perturbations for ELM control--an important class of periodic instabilities that degradate confinement, with applications to ITER.

The PB3D code is freely available and well-documented.

website: PB3D.github.io

source: github

Feb '18 - Current **Pylgrim**

Elementary Shortest Path Problem with or without Resource Constraint

Python implementation of some promising algorithms for the elementary shortest path problem from recent publications. Currently these include [Di Puglia Pugliese et all, 2016, Comput Optim Appl, 63] and [Boland et all, 2006, Oper Res Lett].

The ESPPRC problem is NP-hard, so the solution of it in an efficient manner is a interesting mathematical and computational problem. Though a high-performance implementation would certainly benefit from being implemented in a language such as C or C++, this python package was created to have easy access to some of the most modern algorithms and to benchmark and learn from them.

website: github

Jan '18 - Current **Kraemer**

High-frequency crypto automated arbitrage trader

Co-creator. Challenging collaborative project drawing from a variety of expertises, combining computational sciences with mathematicical and physical knowledge. Supported by both state of the art cryptocurrency financial modelling and deep learning strategies.

SKILLS

Languages

English	★★★★★
Dutch	★★★★★
Spanish	★★★★★
French	★★★★★
German	★★★★★
Portuguese	★★★★★
Italian	★★★★★

Computer

- **Linux** · daily and much-preferred operating system
- **vim** · daily and much-preferred editor
- **LaTeX** · preferred tool for documents
- **html, CSS** · used for this curriculum vitae (with markdown ➔ Pandoc)
- **git** · for version control of virtually all my documents and projects
- **ParaView, VisIt** · favorite 3-D visualization tools, combined with HDF5 and XDMF
- **HDF5 with XDMF** · best data model, both for storage and for visualization

Programming

- **Python** · numpy, scipy, pandas, cython, aioprocessing, ...
- **Fortran** · HPC application such as PB3D
- **TensorFlow, Keras** · Deep Learning quick modelling
- **MPI, OpenMP** · parallelization for HPC
- **jupyter notebooks** · exploratory programming
- **Bash, Make, ...** · daily scripting and development
- **MySQL** · simple database
- **LaTeX, LuaTeX** · large documents, such as Ph.D. dissertation

Other

- **Fusion DC** 2016 Program Representative
- **TGD Solutions** board member

AWARDS

2017 **Ph.D. Research Award**

European Physical Society

The Award The Plasma Physics Division of the European Physical Society (EPS) shall grant up to four prizes annually to young scientists from the 38 European countries associated with the EPS in recognition of truly outstanding research achievements associated with their PhD study in the broad field of plasma physics.

website: EPS

REFERENCES

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