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, statistics, linear algebra, graph theory, neural networks. Very inquisitive and analytical. Currently looking for exciting new challenges in the fields of data science and artificial intelligence. Especially interested in Bayesian Machine Learning, a thoroughly enjoyable union of mathematical rigor and machine learning superpowers.

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

EXPERIENCE

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

ITER Organization

- Responsible for investigation of 3-D effects on Edge-Localized Modes (ELM) stability
- Located at multi-billion dollar ITER project, world's most advanced nuclear fusion research reactor
- Using numerical code PB3D, developed as part of my Ph.D. project (see below)

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

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

- Designed research project to improve understanding of *high-n* instabilities
- Important class of instabilities in toroidal magnetic confinement devices for nuclear fusion
- Developed dedicated mathematical theory [Weyens et al, 2014, P.o.P, 21, 4]
- Designed optimized numerical code, PB3D [Weyens et al, 2017, J.c.P, 330]
- Used modern Fortran, 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.

- Fusion Engineering & Fusion Science
- Focus on (European) culture and language

Graduated top 5%.

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

University of Leuven · Technische Universität Berlin (exchange)

- Multidisciplinary curriculum
- Strong ties to industry
- (Thermo-)Mechanical & Electrical engineering
- Focus on economical aspects of energy
- Personal experience: exchange in TU Berlin for first half curriculum

Graduated top 15%.

October '18	**Online Course - Bayesian Methods for Machine Learning** (part of Advanced Machine Learning)

Coursera advanced, by Higher School of Economics Moscow

- Expectation-Maximization (EM) algorithm
- Variational Inference & Latent Dirichlet Allocation
- Markov chain Monte Carlo
- Variational Autoencoder
- Gaussian processes & Bayesian optimization
- PyMC3, GPy, GPyOpt

Graduated with honors.

certificate: link

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

Coursera intermediate, by Andrew Ng

- Deep learning foundations by master educator Andrew Ng
- Convolutional neural networks
- Sequence models: RNN, (Bi)LSTM, GRU
- Optimizers: Stochastic, Adam, AdaMax
- Overfitting: dropout, BatchNorm
- TensorFlow & Keras

certificate: link

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

CINECA, Casalecchio Di Reno

- 10 day intense graduate HPC course
- Modern parallel computing systems for computation
- HPC introduction, parallel architectures, MPI & OpenMP
- Profilers & debuggers

PROJECTS

Jan '13 - Current	**PB3D**

Peeling-**B**allooning in **3**-**D**

- Part of my doctoral research project.

- Capable of efficiently analyzing peeling-ballooning stability of toroidal magnetic confinement devices
- Crucial for nuclear fusion
- Freely available and well-documented

for experts:

- Mathematical mimization of functional, leading to generalized eigenvalue equation
- *high-n* instabilities easily excited, couple plasma (150 million °C) to the cold reactor walls (−260.8 °C)
- General 3-D configurations, perturbed plasma edge [Weyens et al, 2017, J.c.P, 330]
- Postdoctoral research: investigate 3-D effects
  - resonant magnetic perturbations for ELM control (RMP)
  - toroidal field coil (TF) ripple

website: PB3D.github.io

source: github

Feb '18 - Current **Pylgrim**

Elementary Shortest Path Problem with or without Resource Constraint

- Python implementation of promising algorithms for Elementary Shortest Path Problem (ESPP)
- From recent publications, to benchmark and learn - currently:
  - [Di Puglia Pugliese et all, 2016, Comput Optim Appl, 63]
  - [Boland et all, 2006, Oper Res Lett].
- problem is NP-hard, so efficient solution is interesting mathematical and computational problem

website: github

Jan '18 - Current **Kraemer**

High-frequency crypto automated arbitrage trader

- Co-creator.
- Collaborative project drawing from variety of expertises
- Based on computational sciences & mathematicical and physical knowledge
- Supported by state of the art cryptocurrency financial modelling & deep learning strategies

Oct '18 **Facial Composits: Finding the Suspect**

Capstone project for Bayesian Methods for Machine Learning

- Helps you with getting face of suspect in crime
- Employed variational autoencoder in Keras and Tensorflow to generate face images
- Combined with Gaussian Process Optimization through GpyOpt
- Interacts with you through simple binary *yes/no* questions
- Optimized program to require minimal amount of interaction

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

- **Fortran** · HPC application such as PB3D
- **Python** · numpy, scipy, pandas, cython, aioprocessing, ...
- **Matlab** · Daily scripting but also larger applications
- **C++** · especially useful paired with the BOOST library
- **TensorFlow**, **Keras** · Deep Learning quick modelling
- **PyMC3**, **GPy**, **GPyOpt** · Bayesian Machine Learning
- **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 & SCHOLARSHIPS

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

2019 **PyTorch Scholarship Challenge**

Facebook

10k recipients selected worldwide to start using PyTorch for deep learning.

website: Udacity

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