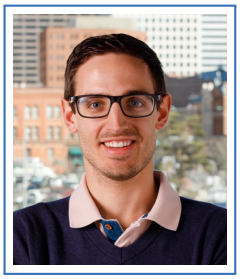

Angel Farguell Caus

Curriculum Vitae

I am passionate about Science person who loves applying Mathematical techniques to the real World using advanced computing skills. I also love music and outdoor activities.

Programming languages and main projects

- **C**: Implemented a solution of the heat diffusion equation using finite differences and a connect 4 game (MinMax heuristic problem).
- **C++**: Implemented some parallel strategies from a serial code (matrix multiplication and Montecarlo simulation).
- **Python**: Implemented routines to process, analyze and visualize NetCDF files from WRF using data assimilation, and gathered MODIS/VIIRS Active Fires satellite data for a given time window and bounding box generating input for statistical interpolation to estimate fire arrival time using SVM machine learning technique (repository at `https://github.com/openwfm/JPSSdata`).
- **Octave/Matlab**: Machine learning of seizure data for a Kaggle problem, heart rate controller during running exercises, and interpolation of the fire arrival time using projected preconditioned gradient descent method and multigrid descent method (repository at `https://github.com/Fergui/Multigrid`).
- **Fortran**: Some experience reading and writing some parts of a coupled atmosphere-fire simulator, WRF-SFIRE.
- **Java**: Implemented a space invader game and a logistic program for a jewelery.
- **JavaScript**: Implemented a web to filter the tweets talking about listening a song in real-time in order to analyze their properties using a musical data base. Repository at `https://github.com/lemonzi/TwitterBrainz` and public website at `http://twitter-brainz.herokuapp.com`.
- **R**: Using supervised and unsupervised learning strategies and principal orthogonal directions from some datasets (for instance a project doing cluster classification from meteorological stations in Catalonia at different years).
- **AMPL**: Solving a linear programming model based on barycenters method.

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Birth: 02/21/1992. Post-Doctoral Fellow at University of Colorado Denver.

Computer skills

- **Operating Systems**: Linux (Ubuntu and Debian), OS X, and Windows.
- **UNIX**: Bash scripting and UNIX knowledge.
- **High Performance Computing**: Some experience implementing shared parallel computing (OpenMP) and distributed parallel computing (MPI). Little experience on GPU programming in CUDA and OpenACC.
- **Manage of repositories**: Git and CVS.
- **Microsoft Office**: Microsoft Word, Microsoft Excel and Microsoft Powerpoint.
- **LaTeX**: Writing articles and presentations.

Education

2015–2018 **PhD in Computer Science**, *Autonomous University of Barcelona*, Barcelona.
Title: Modeling Wildland Fire Behaviour using a Multi-physics System on HPC Platforms.
Department: Computer Architecture & Operating Systems.
Advisors: Dra. Ana Cortés Fité, Dr. Josep Ramón Miró Cubells, and Dr. Jan Mandel.
Main contributions:

- Analysis and experiments using WRF-SFIRE [6, 3, 4] and a comparison with a non-coupled wildfire simulator (FARSITE) [2].
- Solution of the Level Set Method in strong and heterogeneous rate of spreads. Included in the main WRF-SFIRE repository `https://github.com/openwfm/wrf-fire`.
- New method to interpolate fire arrival time between two observed perimeters solving an optimization problem minimizing the residuals of the Eikonal equation. The projected preconditioned gradient descent method and the multigrid gradient descent method were tested in different scenarios. Implemented at `https://github.com/Fergui/Multigrid` repository.

More information:
`http://grupsderecerca.uab.cat/hpca4se/`

2014–2015 **Master's Degree in Modelling for Science and Engineering**, *Autonomous University of Barcelona*, Barcelona.

- **Specialisation in Data Science**
  - Master Thesis: Study and comparison among different data assimilation methods in surface meteorology.

More information:
`https://www.uab.cat/web/estudiar/official-master-s-degrees/content/content/modelling-for-science-and-engineering-1096480963070.html?param1=1307112830469`

2010–2014 **Bachelor's Degree in Mathematics**, *Autonomous University of Barcelona*, Barcelona.

- **Minor in Mathematical Engineering and Minor in Econumatematics**.
  - Degree Project: Simulation and control of the heart ratio during running exercises.

More information:
`http://www.uab.cat/web/estudiar/ehea-degrees/study-plan/study-guides-1345467897127.html?param1=1216102918128`

2012–2016 **Bachelor of Music**, *Liceu Music College of Barcelona*, Barcelona.

- **Major in Performance - Classical and Contemporary Orchestral Instruments**:
  - Instrument: Viola.
  - Degree project: Music and proportion: Golden ratio and Fibonacci's succession in the history of music.

More information:
`http://www.conservatoriliceu.es/en/higher-conservatory/programs/bachelor-of-music/15-superior/titol-superior/433-classical-and-contemporary-orchestral-instruments`

Experience

Research

2019–Present **Post-Doctoral Fellow**, *Unversity of Colorado Denver*, Denver.

Working at Mathematical and Statistical Science Department with Dr. Jan Mandel in some research lines with a coupled atmosphere-wildland fire model, WRF-SFIRE.
Main contributions:

- Many contributions and transition from Python 2 to Python 3 of all the components of the WRFx system:
  - *wrfxctrl*: `https://github.com/openwfm/wrfxctrl`.
  - *wrfxweb*: `https://github.com/openwfm/wrfxweb`.
  - *wrfxpy*: `https://github.com/openwfm/wrfxpy`.
  - *WPS*: `https://github.com/openwfm/WPS`.
  - *WRF-SFIRE*: `https://github.com/openwfm/WRF-SFIRE`.

  More details in [15].
- Satellite data acquisition of all Thermal Anomalies/Fire products (MODIS, VIIRS, GOES16, and GOES17) using hierarchy of classes in python in *wrfxpy* repository [10, 14].
- New visualization of satellite hot-spots computing the real size of the pixels depending on the instrument, the scan angle, and the location of the pixels. Example for 2020 California fires at `https://arcg.is/1eDHDn`.
- Machine learning application of Support Vector Machine for initialization and data assimilation of a coupled atmosphere-fire simulator (WRF-SFIRE) by estimation of fire arrival time using satellite data and infrared fire perimeters [7, 16, 15, 13, 11].

2017–2018 **Research Assistant**, *Unversity of Colorado Denver*, Denver.

Working at Mathematical and Statistical Science Department with Dr. Jan Mandel in some research lines with a coupled atmosphere-wildland fire model, WRF-SFIRE:

- Execution time analysis of the MPI and OpenMP parallelizations [5].
- Solving spurious ignition fires of the level set method implemented in WRF-SFIRE in heterogeneous rates of spread using a local minima strategy.
- Temporal resolution analysis of the potential temperature insertion height from the fire solution to the atmospheric model using burner ideal experiment as a test case.
- Two perimeter interpolation of fire arrival time using an optimized line search method through the projected preconditioned gradient descent and multigrid gradient decent methods [8, 1].

2015–2016 **Internship**, *Catalan Meteorological Service (Meteocat)*, Barcelona.

Study of different data assimilation strategies in order to use them as a real time surface analysis tool. As a result of this internship, a Master Thesis was written, a poster at European Geosciences Union General Assembly (EGU) was presented, and an article at International Conference on Computational Science (ICCS) was published [17, 9].

Teaching

2015–2017 **Teacher Assistant**, *Autonomous University of Barcelona*, Barcelona.
Teaching technical classes of 2nd year Operating Systems subject of the Informatics degree. The classes were about shell script, processors using fork in C and POSIX threads using pthreads in C.

Music

2010–2017 **Many professional orchestras**, *Viola orchestra musician*.

Courses

- **HPC-based Simulations, Engineering and Environment**. Barcelona Supercomputing Center (BSC), Barcelona, Spain, February 16-18, 2016.
- **Parallel Programming of High Performance Systems**. Erlangen Regional Computing Centre (RRZE) with the collaboration of Leibniz Supercomputing Centre, Erlangen, Germany, May 7-11, 2016.
- **Performance Analysis and Tools**. Barcelona Supercomputing Center (BSC), Barcelona, Spain, May 9-10, 2016.
- **Earth Sciences Simulation Environments**. Barcelona Supercomputing Center (BSC), Barcelona, Spain, from November 30 to December 2, 2016.
- **XXII Jornades de Meteorologia Eduard Fontserè: Meteorologia i Energies Renovables**. Associació Catalana de Meteorologia (ACAM), CosmoCaixa Barcelona, Spain, November 26, 2016.
- **Thirteenth International Summer School on Advanced Computer Architecture and Compilation for High-Performance and Embedded Systems**. Fiuggi, Italy, July 9-15, 2017.
- **Learn How to Accelerate Your Code with OpenACC**. NVIDIA and Pittsburgh Supercomputing Center online course. October 19-November 2, 2017.
- **Computational Methods in Non-Linear Programming**. Attended a class in the University of Colorado Denver. January-April, 2018.
- **GOES-R Workshop for Fire and Forest Meteorology Research**. 12th Fire and Forest Meteorology Symposium. Boise, Idaho, May 18, 2018.
- **JCSDA Summer Colloquium on Satellite Data Assimilation 2018**. NASA/NOAA/DoD Joint Center for Satellite Data Assimilation (JCSDA), Bozeman, Montana, from July 22 to August 3, 2018.
- **Introduction to Machine Learning**. Attended a class in the University of Colorado Denver. August-November, 2019.
- **Mini-tutorials: WRF in the Cloud and WRF-Python**. Joint WRF and MPAS Users' Workshop 2019. NCAR, Boulder, Colorado, 14 June, 2019.
- **Statistical & Machine Learning**. Attended a class in the University of Colorado Denver. January-April, 2020.
- **Introduction to Containers**. Zoom CHPC lecture. Online April 21, 2020.
- **Machine Learning**. Coursera course by Stanford University. Instructor: Andrew Ng. Online July-September, 2020. Certificate with Credential ID HEGG7K926GJS.

Languages

- **Native language**: Spanish and Catalan.
- **Second language**: Proficiency English.

Publications

[1] Angel Farguell Caus, James Haley, Adam K. Kochanski, Ana Cortés Fité, and Jan Mandel. Assimilation of fire perimeters and satellite detections by minimization of the residual in a fire spread model. In *International Conference on Computational Science, ICCS 2018, 11-13 June 2018, Wuxi, China*, 2018.

[2] A. Farguell, N. Chiaraviglio, A. Cortés, T. Margalef, and J.R. Miró. Farsite vs. wrf-sfire: simulación de la propagación de incendios forestales, una cuestión de precisión y de tiempo. In *XXVII Jornadas de Paralelismo (JP2016). Sociedad de Arquitectura y Tecnología de Computadores (SARTECO)*, 2016.

[3] A. Farguell, A. Cortés, T. Margalef, and J.R. Miró. Spatial and time resolutions: two critical aspects for operational forest fire spread simulation. In *World Conference on Natural Resource Modeling (WCNRM)*, 2017.

[4] A. Farguell, A. Cortés, T. Margalef, J.R. Miró, and J. Mercader. A multi-physics forest fire spread model on multi-core systems. In *Computational and Mathematical Methods in Science and Engineering (CMMSE)*, 2017.

[5] Angel Farguell, Ana Cortés, Tomàs Margalef, Josep R. Miró, and J. Mercader. Scalability of a multi-physics system for forest fire spread prediction in multi-core platforms. *The Journal of Supercomputing*, Mar 2018.

[6] Angel Farguell, Ana Cortés, Tomàs Margalef, Josep Ramon Miró, and J. Mercader. Data resolution effects on a coupled data driven system for forest fire propagation prediction. In *International Conference on Computational Science, ICCS 2017, 12-14 June 2017, Zurich, Switzerland*, pages 1562–1571, 2017.

[7] Angel Farguell, James Haley, Lauren Hearn, Jan Mandel, and Adam Kochanski. Recovering fire arrival time from satellite data by machine learning. In *Joint WRF and MPAS Users' Workshop 2019. NCAR, Boulder, 10-14 June*, 2019.

[8] Angel Farguell, James Haley, Jan Mandel, Adam Kochanski, and Sher Schranz. Assimilation of fire perimeters and satellite observations into a coupled fire-atmosphere model. In *American Meteorological Society's 12th Fire and Forest Meteorology Symposium, 13-17 May 2018 in Boise, Idaho*, 2018.

[9] Angel Farguell, Jordi Moré, Ana Cortés, Josep Ramon Miró, Tomàs Margalef, and Vicent Altava. Reducing data uncertainty in surface meteorology using data assimilation: A comparison study. In *International Conference on Computational Science 2016, ICCS 2016, 6-8 June 2016, San Diego, California, USA*, pages 1846–1855, 2016.

[10] James Haley, Angel Farguell Caus, Adam Kochanski, Jan Mandel, and Sher Schranz. Data likelihood of active fires satellite detection and applications to ignition estimation and data assimilation. In *VIII International Conference on Forest Fire Research, 9-16 November 2018 in Coimbra, Portugal*, 2018.

[11] K A Hilburn, A Kochanski, J Mandel, N Nikolov, M Vejmelka, and A Farguell. Integrating satellite fire detections with coupled fire-weather-smoke forecasting system wrfx for improved wildland fire decision making. In *A53S - Monitoring and Predicting the Impacts of Extreme Fire and Dust Events Using the New Generation of Satellite Trace Gas and Aerosol Observations II Posters, AGU Fall Meeting, San Francisco CA, December 9-13*, 2019.

[12] Derek V. Mallia, Adam K. Kochanski, Shawn P. Urbanski, Jan Mandel, Angel Farguell, and Steven K. Krueger. Incorporating a canopy parameterization within a coupled fire-atmosphere model to improve a smoke simulation for a prescribed burn. *Atmosphere*, 11(8):832, August 2020.

[13] J Mandel, A Farguell, J Haley, L Hearn, A Kochanski, and K A Hilburn. Assimilation of satellite fire detections in coupled atmosphere-fire model wrf-sfire by machine learning. In *NG21B - Advances in Data Assimilation, Predictability, and Uncertainty Quantification III Posters, AGU Fall Meeting, San Francisco CA, December 9-13*, 2019.

[14] J Mandel, A Kochanski, E A Ellicott, J Haley, A Farguell, L Hearn, and K A Hilburn. Retrieving fire perimeters and ignition points of large wildfires from satellite observations. In *Poster NH23C 0859, AGU Fall Meeting, Washington DC, December 10-14*, 2018.

[15] J Mandel, M Vejmelka, A Kochanski, A Farguell, J Haley, D Mallia, and K A Hilburn. An interactive data-driven hpc system for forecasting weather, wildland fire, and smoke. In *HPC for urgent decision making (UrgentHPC) workshop, Supercomputing 2019 (SC19), Denver CO, November 17*, 2019.

[16] Jan Mandel, Angel Farguell, James Haley, Lauren Hearn, and Adam Kochanski. Challenges and opportunities in bayesian and support vector machine estimation of fire arrival time in a coupled atmosphere-wildland fire model. In *Research Challenges and Opportunities at the interface of Machine Learning and Uncertainty Quantification. University of South California, July 24-26*, 2019.

[17] Jordi Moré, Àngel Farguell, and Vicent Altava. Using laps/stmas as a real time surface analysis tool. In *Poster EGU2016-5597, European Geosciences Union General Assembly (EGU), Vienna, Austria, 17-22 April*, 2016.