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Bio: I am research professor at the Technical Institute of Tijuana in Mexico (ITT), working at the Department of Electric and Electronic Engineering, and the Engineering Sciences graduate program, of which I am co-founder and where I am involved in interdisciplinary research within the fields of evolutionary computation, computer vision, machine learning, pattern recognition and autonomous robotics. My work focuses on Genetic Programming (GP) and developing new learning and search strategies based on this paradigm. I received an **Electronic Engineering degree (2002)** and a **Masters in Computer Science (2004)** from **ITT**, as well as a **Doctorate in Computer Science from CICESE research center in Mexico (2008)**. I have developed research collaborations with a variety of institutions, such as CINVESTAV-IPN and CITEDI-IPN in Mexico, the University of Bordeaux and INRIA in France, University of Lisbon and NOVA-IMS in Portugal and the University of Extremadura in Spain. I have published over 60 journal papers, 60 conference papers, 18 book chapters, and have edited three books of the NEO workshop series of which I am series co-chair and the last two edited books from the Genetic Programming Theory and Practice workshop which I have been co-organizing. I am also Associate Editor of the Genetic Programming and Evolvable Machines journal. I have also been co-organizer of the ALEA track at EPIA 2020, and a regular PC member of top conferences, including GECCO, CEC, PPSN, EvoStar, CVPR, ECCV and others, and served as co-chair for the GP track at GECCO in 2021 and 2022. I have also been PI or Co-PI for various national and international research grants, and have received over 1,000 citations according to Google Scholar and Scopus for my work.

Students
1. **Masters students:** a total of 12 students have worked under my supervision (7 graduated and 5 in process)
2. **Doctoral students:** a total 11 doctoral students have worked under my supervision (5 graduated and 8 in process)

Recent Journal Papers – Published and Accepted (Total of 60)
1. J. C. Dibene, Y. Maldonado, **L. Trujillo** and E. Dunn, "Prepare for Ludicrous Speed: Marker-based Instantaneous Binocular Rolling Shutter Localization," in IEEE Transactions on Visualization and Computer Graphics, doi: 10.1109/TVCG.2022.3150485.
2. Cerrada, Mariela, **Leonardo Trujillo**, Daniel E. Hernández, Horacio A. Correa Zevallos, Jean C. Macancela, Diego Cabrera, and René Vinicio Sánchez. 2022. "AutoML for Feature Selection and Model Tuning Applied to Fault Severity Diagnosis in Spur Gearboxes" Mathematical and Computational Applications 27, no. 1: 6.
3. Edgar Galván, **Leonardo Trujillo**, Fergal Stapleton, Semantics in Multi-objective Genetic Programming, Applied Soft Computing, V. 115, 2022, p. 108143.
4. Torres, N., **Trujillo, L**., Maldonado, Y., & Vera, C. (2021). Correction of the Travel Time Estimation for Ambulances of the Red Cross Tijuana using Machine Learning. Computers in Biology and Medicine, 104798.
5. **Trujillo, L.,** Villanueva, O.M. and Hernandez, D.E. 2021. A Novel Approach For Search-Based Program Repair. IEEE Software. 38, 4 (Jul. 2021), 36–42.
6. Rodriguez, D. A., Diaz-Ramirez, A., Miranda-Vega, J. E., **Trujillo, L**., & Mejia-Alvarez, P. (2021). A Systematic Review of Computer Science Solutions for Addressing Violence against Women and Children. IEEE Access, 9, 114622–114639

Edited Books (5))
1. Genetic Programming Theory and Practice XVIII. (2022). In W. Banzhaf, **L. Trujillo**, S. Winkler, & B. Worzel (Eds.), Genetic and Evolutionary Computation. Springer Singapore. https://doi.org/10.1007/978-981-16-8113-4
2. Genetic Programming Theory and Practice XVII. (2020). In W. Banzhaf, E. Goodman, L. Sheneman, L. Trujillo, & B. Worzel (Eds.), Genetic and Evolutionary Computation. Springer International Publishing. https://doi.org/10.1007/978-3-030-39958-0
3. **Leonardo Trujillo**, Oliver Schütze, Yazmin Maldonado and Paul Valle editors. Numerical and Evolutionary Optimization – NEO 2017, Springer series on Studies in Computational Intelligence, Vol. 785, 2019.
4. Yazmin Maldonado, **Leonardo Trujillo** and Oliver Schütze editors. NEO 2016: Results of the numerical and evolutionary optimization workshop NEO 2016 and the NEO Cities 2016 Workshop held on September 20-24, 2016 in Tlalnepantla, Mexico, series Studies in Computational Intelligence, Vol. 731, 2018.
5. Oliver Schütze, **Leonardo Trujillo**, Pierrick Legrand, and Yazmin Maldonado edtors. NEO 2015: Results of the Numerical and Evolutionary Optimization Workshop NEO 2015 held at September 23-25 2015 in Tijuana, Mexico, series Studies in Computational Intelligence, Vol. 663, 2017.

Recent International Conferences (Total of 60)
1. Víctor R. López-López, **Leonardo Trujillo**, and Pierrick Legrand. 2018. Novelty search for software improvement of a SLAM system. In Proceedings of the Genetic and Evolutionary Computation Conference Companion (GECCO '18), Hernan Aguirre (Ed.). ACM, New York, NY, USA, 1598-1605.
2. Uriel Lopez, **Leonardo Trujillo**, Yuliana Martinez, Pierrick Legrand, Enrique Naredo and Sara Silva. RANSAC-GP: Dealing with Outliers in Symbolic Regression with Genetic Programming. In Mauro Castelli et al. editors, EuroGP 2017: Proceedings of the 20th European Conference on Genetic Programming, volume 10196, pages 114-130, Amsterdam, 2017, Springer Verlag.

Description of the Research Group

We work at Tecnológico Nacional de México/Instituto Tecnológico de Tijuana (ITT), in the Engineering Sciences Graduate Program (http://www.pcitectijuana.mx/). Our research group at ITT, which we affectively refer to as TREE-LAB (GPers will underatnd the name I hope), focuses on research related to Genetic Programming, Evolutionary Computation and Machine Learning applications. Currently, we have 3 master students and eight doctoral students working in our team, either locally or in other parts of Mexico. A quick overview of the topics covered by these theses will convey the type of work we do:

- Genetic Improvement of Software with Novelty Search
- Transfer Learning with Genetic Programming Feature Construction
- GPU and FPGA implementations of GP and GSGP
- Symbolic Regression under extreme conditions with RANSAC
- Industry 4.0 in Tijuana and Mexico
- Localization and Dispatching of ambulances in Tijuana
- Machine Learning for:
  - Wind Turbine Fault Detection
  - Gear-Box Fault Detection

We have also developed several projects with local industry, in:
- EEG classification of mental states
- Computer Vision inspection of production lines
- Prediction of faults in production lines

Our students come from diverse backgrounds, including Computer Engineering, Electronic Engineering and Mechanical Engineering; our goal is always to put the student in an optimal position to make a significant contribution in these fields. We also have a long history of collaborations with research groups all over the world, including Mexico, France, Spain, Portugal, Ireland, USA, and others.

We are not a "high-tech" lab, but have a decent amount of equipment for data intensive Computer Science research. We have several Dell Xeon Workstations with NVIDIA GPUs, a Dell R430 Xeon server, an HP ProLiant Xeon server, and our "crown jewel" an IBM Power 8 server with 512 GB RAM and 2 Tesla P100 GPU Cards (soon to be fully equipped with 4 cards) for Machine Learning research. We also collaborate with other labs at ITT that have a variety of other computing platforms, including state-of-the-art FPGA development boards, Raspberry Pi Kits, Arduino Kits, and DACs for specialized application development.

Description of the Work to be Carried Out

For the Species program, we want to propose the following possible project for a student:

1. **Expanding our GPU-based GP systems for regression and classification:** We are currently developing our own GP implementations using CUDA programming, both of GP and GSGP. Both of them use a linear genome representation and a stack-based interpreter. While the baseline algorithms are basically done (one has been submitted for publication and another is 95% done), we want to enhance these implementations with local search methods, following our previous works [1,2,3] and with other techniques, such as model stacking and wrapper-based approaches with GPU-based ML methods [4,5]. Two specific areas of interest that we could explore is making our models robust to outliers with efficient implementations of the methods proposed in [6], and studying transfer learning in a large scale following [5].

REFERENCES:

1. Emigdio Z-Flores, Leonardo Trujillo, Oliver Schütze, and Pierrick Legrand. 2015. A Local Search Approach to Genetic Programming for Binary Classification. In Proceedings of the 2015 on Genetic and Evolutionary Computation Conference (GECCO '15), Sara Silva (Ed.). ACM, New York, NY, USA, 1151-1158.
2. Mauro Castelli, Leonardo Trujillo, Leonardo Vanneschi, Sara Silva, Emigdio Z-Flores, and Pierrick Legrand. 2015. Geometric Semantic Genetic Programming with Local Search. In Proceedings of the 2015 on Genetic and Evolutionary Computation Conference (GECCO '15), Sara Silva (Ed.). ACM, New York, NY, USA, 999-1006.
3. Perla Juárez-Smith, Leonardo Trujillo, Mario García-Valdez, Francisco Fernández de Vega, Francisco Chávez. Local Search in Speciation-based Bloat Control for Genetic Programming, Genetic Programming and Evolvable Machines, 20:3, 351–384, 2019.
4. Muñoz, L., Trujillo, L. & Silva, S. Transfer learning in constructive induction with Genetic Programming. Genetic Programming and Evolvable Machines, 1–41, 2019.
5. Muñoz, L., Trujillo, L., Silva, S., Castelli, M., Vanneschi, L. Evolving multidimensional transformations for symbolic regression with M3GP. Memetic Comp., vol. 11, no. 2, pp. 111-126, 2019.
6. Uriel Lopez, Leonardo Trujillo, Yuliana Martinez, Pierrick Legrand, Enrique Naredo and Sara Silva. RANSAC-GP: Dealing with Outliers in Symbolic Regression with Genetic Programming. In Mauro Castelli et al. editors, EuroGP 2017: Proceedings of the 20th European Conference on Genetic Programming, volume 10196, pages 114-130, Amsterdam, 2017, Springer Verlag.

Reasons to accept our invitation:

1. **We are working on innovative GP research:** As I hope the list of topics presented above reveals, we are really interested in pushing GP forward within the wider ML ecosystem that is currently all over the computer science landscape.
2. **Accommodation:** Unfortunately, the ITT does not offer special rooms for visiting study or faculty, so we would need to find a proper room for rent, which are available near by the institution, since there are several higher learning institutions in the area.
3. **Additional funding:** It may be possible to offer a travel grant for the student that visits us, but we cannot guarantee this at the moment. For now, I would leave it as 70% (yes)/30% (no) chance we have it, but are working to guarantee it.
4. **Tijuana:** The city is a unique experience for sure, the cross-cultural border town is unlike most cities, the border between Mexico and the USA is at the center of many macro-economic and macro-social phenomena, making its culture and society quite special. There are also great places to visit nearby (https://www.tripadvisor.com/Attractions-g499403-Activities-Valle_de_Guadalupe_Ensenada_Municipality_Baja_California.html). Another interesting aspect is the food, good gracious the food, it is just excellent! (https://www.10news.com/news/tijuana-reinventing-itself-through-food), nobody can deny this (https://www.sandiegouniontribune.com/entertainment/dining-and-drinking/sd-me-tj-visit-20170105-story.html), what can you expect from the home of the Cesar Salad (https://www.withlovepaperandwine.com/food/original-ceasars-salad-tijuana-casears-restaurant-bar) .