

Statement of Philosophy

I feel fortunate to be able to combine everyday my passions of teaching and conducting research. Through **teaching**, I am fortunate to be able to witness and contribute to the growth and development of our students. Through **research**, I am happy to share with students my passion and on-going curiosity in a field that I love. During presentations or as anecdotes in my classes, I am able to share my experience in research with many people. Students who join my group are given the opportunity to dig deeper in their interest in computer science, their horizon is broadened. And having students in my group also enriches me: having people with different points of views, different backgrounds, different styles working with me is always a source of such rich conversations and can lead to great scientific contributions. Overall, I love that sharing my passion for research is part of my work as a faculty and the fact that UTEP's mission is **Access and Excellence** is a perfect fit for that.

The mission of **Access** drives my teaching style. I practice kindness and empathy, while maintaining very high standards. Not all of our students might come very well prepared or very well ready to fully focus on our program (because they have to work outside of campus, they have to support family members, they have kids, etc.) but I believe that it is important to see beyond these, to believe in the students' potential, and to provide support, guidance, and help. Access also drives my passion for broadening participation to more women in the field of computing. There is no biological reason why women should not be equally represented in this field, but there are many hurdles that keep them away from considering it (or from staying in it if they ever make it thus far). My strong belief in access is the reason why I am engaged in many initiatives to recruit and retain women in computing.

The mission of **Excellence** almost goes without saying: the point about it lies mostly in understanding what one needs to excel at. In my work, it is my constant drive to excel in the three main components of my activities: research, teaching, and service. Although, in research and service, it goes without saying, in teaching, besides striving to excel as an instructor, I also aim at making my students excellent professionals.

Truly combining **Access and Excellence** lies in the faith that, as a faculty, we can develop our students into professionals who can be successful and make a difference, which itself lies in the faith that all our students can succeed if given an adequate amount of support. The mission of UTEP is crucial to fueling diversity as we recognize everyone's potential and has the potential to lead to fascinating innovations as diverse groups of people drive innovation.

In what follows, I go over my philosophy of teaching, research, and service. Service, although not salient in my introduction, is a crucial, yet silent, element of my work. I believe that service is necessary to support efforts in teaching and research. Teaching would be blind if it stopped at the door of the classroom. On the opposite, it actually benefits from recruitment / outreach efforts, from supporting students outside the classroom via, e.g., students organizations, from having solid programs and institutions (which need governance and structure). Research cannot function properly if nobody is willing to review articles or projects, to organize venues for disseminations (books, journals, conferences, workshops). All of these call for service, which as a result constitute a significant part of my activities.

□ Teaching

I love to solve problems and I love teaching. I see teaching as a problem that needs solving: “How can I make sure that my students are best prepared for their next step?”, whether they are students who take a class with me, students of my research group whom I mentor, students I advise once a semester at the time of picking courses, or students I informally mentor in the student organizations I advise or the outreach programs I participate in. In each of these capacities, I wear my teacher hat.

In my interactions with students, I am driven by my goals of access and excellence. **Access** is given to our students by the University, but it is crucial that we, as faculty in the classrooms, make them feel that they actually have their place at the University. I believe that it is crucial that we see beyond the preparedness and common constraints and hardships our students face, to focus on their potential and its development. **Excellence** is demanding and ensuring that our students meet high standards and that they be exposed to high-quality opportunities (e.g., via meaningful internships or research experiences). It is also demanding the same of myself as an instructor. As a result, I seek any opportunity to be trained as an instructor via professional development workshops such as problem-based learning workshops at UTEP, NSF and CRA meetings where teaching performance is central. I submitted a educational proposal to Google and was funded to redesign my CS1 course in spring 2016. I also took the opportunity of UTEP being a member of the Texas Regional STEM Degree Accelerator (STEM Accelerator) initiative to participate in a workshop conducted by Olin College (at UTEP) about teaching and students’ motivation. I have furthered this opportunity by proposing and being selected as a STEM Accelerator partner to redesign one of my classes: the introduction to computer science, which is so crucial in ensuring the buy-in of our students in our program. I also regularly review textbooks, paper and online.

A true **Access and Excellence** mission calls for **excellence** for **all** students, not just a few that we would filter through their years of study. Indeed, making **true access** and **excellence** happen requires embracing all of our student body and addressing the challenge of attrition¹. *Attrition* is part of the problem I try to address in all my classes and in all my mentoring opportunities with our students. In the classroom, I believe that building a sense of engagement and belonging, and a strong student identity as a computer scientist (even on occasion just as a student) can make a big difference in students’ performance. Studying this process and the type of identities students were juggling with was part of the focus of an NSF-funded project I was part of, with Elsa Villa as PI, from September 2012 to September 2016². In order to help students identify as students (at least) and best as computer scientists, I promote a classroom atmosphere in which students are encouraged to talk to me, to come to my office, to contact me online. In particular, to break the communication barrier, I make a point in knowing all of my students by name every semester (even when I have had over 90 students): I find that it changes the spirit of many of my students who light up when I call them by name. It also sends the clear message that I know them and that I will be looking out for them. Following up on this, I closely monitor the attendance and performance of my students and contact them as soon as I see that there is a change in their participation or performance. In addition, I have used piazza as a platform for interaction with students since 2010: it allows easy communication with multiple students, instructors (professor and TAs for instance). In particular, it enables students to post questions in the class forum anonymously from

¹The other side of the attrition problem is recruitment: this is something I try to address in my service.

²NSF Research on Gender – Co-PI Latinas in Computer Science and Engineering: A Qualitative. September 15, 2012 – September 14, 2016 extended. Amount: \$524,960.00.

their peers (but not from me, so that I can learn more about my students' struggles and provide more adequate one-on-one help in class or outside the classroom). To further enhance students' identity in our program, I created in fall 2015 a problem-solving club for students of my intro to computer science course to have a time, outside of class, to come and have fun solving problems: this allowed me to show them how much computer science relies on problem-solving skills, and to help them develop their problem-solving skills. I have also, as I have taught this intro class for several semesters since spring 2015, regularly invited students from this class to join my research lab. In fact, I encourage them to join any research lab and I offer my help to facilitate a good match, but I also directly invite students whom I think could benefit from a nudge of help. Some students do not stay more than one or two semesters, but when they leave, they are usually well on track to succeed in the program. Finally, to increase retention, I have also worked on redesigning our department's introduction to computer science (in fall 2014 with David Novick and Monika Akbar, and in fall 2016 by myself). I have created a course on problem solving based on the club I had started in fall 2015. Recently, in spring 2017, I started working, within the NSF IUSE/PFE RED project led by Ann Gates at UTEP, on designing a new problem-solving course of one credit hour, which was successfully implemented in fall 2017.

Improving my teaching to provide a better experience and better future for our students is one of my passions.

□ Research

When thinking of research, one may more easily think of excellence than of access. However, in my research activities, I keep in mind my philosophy of access and excellence: **excellence** in my research (my own as well as my students') while providing and enhancing **access** of our students to research. My main goal in research is to allow more complex computations to be conducted reliably and practically. In other words, when facing hard computational problems, how can we solve them in a practical amount of time while providing meaningful guarantees on the results? And what type of decision can be made on such problems that make them more usable, more practical, more meaningful, while still being solved reliably?

With this research goal in mind, my research has revolved around the topics of **optimization** and **uncertainty quantification** for **decision making**. More specifically, my research since 2012 has followed two main directions. My first focus has been on enabling decision making when there are multiple agents and multiple (most likely conflicting) criteria. This work was conducted in collaboration with Stefano Bistarelli, professor of Computer Science at the University of Perugia, Italy, and funded by a AAAS grant. This part of my work is very important to getting closer to my goal as such types of decisions are everywhere and their setting can easily result in a very large computational problem. Our common approach consisted in exploring and using Dung's argumentation framework. This work has applications not only in situations where human agents are trying to make decisions, but also in situations such as cybersecurity and network safety where a good understanding of safety rules (counterattacks in the framework or graph) that protect against potential attacks can enable avoiding breaches. My second research focus has been on solving large (most commonly nonlinear) dynamic systems in ways that the solutions we obtain are guaranteed, despite possible uncertainty. This work was funded as a project of the Army High-Performance Computing Research Center, hosted at Stanford and funded by ARL. The goal of this work was to enable simulations of very large nonlinear dynamic systems in a significantly reduced amount of time. In this work, in collaboration with Miguel Argaez, from Math at UTEP, I worked on reduced-

order modeling approaches, including via wavelets, and I then proposed to use interval computations to help speed up the reduction process, and then interval constraint-solving techniques to solve the reduced-order model. This allowed to handle potential uncertainty in the models (which was not handled earlier) and to open computational possibilities such as prediction of behavior of dynamic systems (in the field, as opposed to simulations in lab) and recomputation of mission parameters (in the field as well). As a result, we proposed new uses of the models we had to work on, to be more practical and useful in the field for Army applications, but in many non-Army situations as well where understanding a dynamic phenomenon as it unfolds may be crucial.

This research has contributed to the fields of multi-agent multi-criteria decision-making, to uncertainty quantification, reduced-order modeling, and optimization. Our progress the solution of large dynamic systems has allowed us to define new challenges, namely using reduced-order models for predictions as well as for enforcing / excluding behaviors, all of which coming with guarantees, which is the highlight and main difference of our approach, when compared to non-guaranteed statistical or stochastic approaches. While conducting this research work, I have been able to acquire funding from AAAS, NSF, ARL, most of which as PI (\$ 1,338,911 as PI, and \$190,000 as co-PI). I have shown my persistence in seeking funding through the number of other grant proposal I have submitted (to NSF, Google, and other agencies). All of the work mentioned above has been regularly published either at major conferences or journals, as demonstrated by the 17 chapters, 12 journal articles, 19 conference articles published since 2012. My involvement in the fuzzy community was recently acknowledged by my election as the President Elect of the North American Fuzzy Information Processing Society.

Making sure that I give students **access** to research is also very important to me. As an academic advisor of many students in our CS program at UTEP, I always encourage them to get informed about research at UTEP and to join a research group: this is part of my service. As a researcher, I make sure to invite and encourage students to join my research group. I am a firm believer in open research, sharing experience and information. I also value diversity, of backgrounds, genders, and levels. As a result, I see **access as a global concept**, which requires that we disseminate our work for all to see (publications) and seek collaborations with colleagues outside our institution: this not only gives people outside UTEP access to our research but it also gives our UTEP students access to a broader horizon of possibilities.

Since 2012, I have collaborated with a number of researchers within UTEP across departments and colleges, in other US institutions, and abroad (e.g, Italy, Colombia). My interdisciplinary collaborations resulted in joint papers with for instance researchers from departments of mathematics, geological sciences, education. I also always involve students when possible, which results in co-authored-only publications: I have a number of publications only co-authored with students. Integrating students to my research (to research in general) is a way of retaining them and increasing their chances of success. I involve students in my research by inviting them to join my research group, CR2G (Constraint Research and Reading Group, <http://cr2g.constraintsolving.com>), which gathers students at all levels: high-school students (in general in summer), undergraduate, graduate, PhD levels, and post-doctoral researchers. Since 2012, I have worked closely with 2 post-doctoral researchers, 13 Ph.D. students (6 whom I directly advised, 2 of whom graduated and another one is about to (fall 2017); 1 whom I advised while he had joined my research team but whose actual advisor was Vladik Kreinovich; and another 6 Ph.D. students for whom I served as a committee member), 10 Master's students (6 whom I directly advised, 5 of whom graduated; and another 2 whom I advised during their visit at UTEP – international visiting students – and 2 for whom I

served as a committee member), 22 undergraduate students, and about 20 high-school students.

I also believe that involving female students will increase the participation of women by creating role models. I encourage the participation of women in my research group: in particular my focus for interns in summer is on recruiting young high-school women, and I also invite young women students from my CS1 class every semester. Finally, as part of my efforts to give access to research, I also value universal access through online presence (which also increases the visibility of UTEP). Several years ago, my group, CR2G, developed and maintained a research community website, <http://constraintsolving.com>, which attracts a significant amount of web traffic. In 2015-2016, we implemented an online tool, NumConSol, which is fully available online at <http://numconsol.cs.utep.edu>. We also posted standalone versions of our solver, compiled for different OS on our constraintsolving.com website.

□ Service

I see service as an essential component of being a professional: being an active and responsible citizen of my work place and research community. I seek to serve the university population: faculty and students, as well as researchers in my community, and my local community, as best as I can. I therefore dedicate to it a significant portion of my time. I seek to implement the access and excellence mission of UTEP through a range of activities.

At UTEP, I have been active at all levels of the university, from the university to the department levels. In addition to my involvement in the faculty senate until this fall 2017, which allowed me to get a better understanding of the faculty governance at the university and system levels, I have focused my efforts on broadening the participation in computer science, with a special emphasis on women. As a result, I have become the chair of the departmental's undergraduate fundamentals course sequence committee, leading and overseeing changes in our introductory computer science course. I have founded and advised since 2012 UTEP's ACM-W chapter, whose members I mentored very closely: the chapter obtained an NCWIT seed grant in 2014, two Google IgniteCS grants in 2016, and is still working on Google IgniteCS and starting a Google First project: all of these focused on broadening participation through mentoring and outreach. At the local level, I have been involved in the board of advisors of several schools of El Paso: St Patrick's Elementary and Middle School (fall 2014, until summer 2017), Harmony Science Academy (since 2012), Parkland's T-STEM Academy (since 2015), Eastlake High School CSE program (2015), Bel-Air T-STEM Academy (since fall 2017). I have also coordinated the regional affiliate of the NCWIT Aspirations in Computing program since 2011: this program reaches out to young high-school women who enter a local and national competition in which they relate to us their interest, aspirations, experience, and motivation about technology. This is a fantastic program that allows to keep the motivation up in young women at a time (high-school) when studies show that they are at the highest risk of giving up their aspirations in computing. Through this program and many presentations and department visits that I give several times a year, I have been able to reach out to hundreds of young high-school women since 2012. Over a hundred of them have participated in the NCWIT El Paso aspirations and about 20 of them have now been interns in my lab in summers (since 2010).

In my research community, I yearn to be a good citizen, like in all things I do. As a result, I have organized a major international conference and annual workshops with my colleague Vladik Kreinovich: NAFIPS'2016, CoProD'12 to '17, and with colleagues in Europe, S. Bistarelli, F. Santini, E. Monfroy, ACM SAC KRR'2018. I am also part of many program committees and I have reviewed for a number of journals, books, NSF panels, and other conferences as described below. I

became NAFIPS' president elect in January 2017.

Through all the above activities, I always seek access and excellence: reaching out to as many as possible, impacting as many as possible, contributing to high-impact endeavors, seeking activities that broaden access to excellence for our students and our community, while maintaining a high-quality work and mentoring students to reach excellence.