University of California, San Francisco

CURRICULUM VITAE

Name: Gilmer Valdes, PhD, DABR

Position: Associate Professor In Residence, Step 1
Radiation Oncology
School of Medicine

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EDUCATION

2007 - 2009	Higher Institute of Applied Science and Technologies (InSTEC), Havana, Cuba	MS	Radiochemistry	
2009 - 2013	University of California, Los Angeles	PhD	Biomedical Physics	Keisuke Iwamoto
2013 - 2014	University of California, San Francisco	Postdoctoral Fellow	Radiation Oncology	
2014 - 2016	University of Pennsylvania	Medical Physics Resident	Radiation Oncology	

LICENSES, CERTIFICATION

2016	ABR Therapeutic Medical Physics

PRINCIPAL POSITIONS HELD

2016 - 06/2017	University of California, San Francisco	HS Assistant Clinical Professor	Radiation Oncology
07/2017 - present	University of California, San Francisco	Assistant Professor in Residence	Radiation Oncology

OTHER POSITIONS HELD CONCURRENTLY

10/2019 - present	University of California, San Francisco	Assistant Professor in Residence	Epidemiology and Biostatistics

HONORS AND AWARDS

2006	Suma Cum Laude	Higher Institute of Applied Science and Technologies (InSTEC).
2009	Nomination to the Best Young Researcher Award	Cuban Academy of Science
2010	Eugene V. Cota-Robles Fellowship	University of California
2012	Best Oral Presentation, Biomedical Physics Symposium	University of California
2012	Research Supplements to Promote Diversity in Health-Related Research	NIH
2013	First Place, Best Graduate Student Norm Baily Award	AAPM Southern California Chapter
2015	First Place, Young Investigator Award.	AAPM Delaware Chapter
2018	Jean Pouliot Award for Excellence in Teaching	UCSF Medical Physics Residency Program
2023	Future Leaders of Medical Physics	University of Wisconsin, Madison.

KEYWORDS/AREAS OF INTEREST

Medical Physics, Machine Learning, Tree models, Radiation Oncology, Interpretable algorithms, Genomics, Statistics, Expert Augmented Machine Learning.

CLINICAL ACTIVITIES

CLINICAL ACTIVITIES SUMMARY

Acceptance testing and commissioning for two new TrueBeam linacs - Daily and Monthly QA and Annual calibration for TrueBeam and Clinac Series linacs - Daily and monthly QA for double scattering and pencil beam scanning proton systems - Eclipse Treatment Planning for 2D/3D, IMRT, RapidArc and proton planning - Aria/MOSAIQ Patient Management System - HDR planning, daily, monthly and quarterly QA, source calibration - Patient specific QA (proton and photons) - CT monthly QA.

CLINICAL SERVICES

2016 - 2023	Physics HDR Planing and Quality Assurance.	Weekly
2016 - 2018	Commissioning and supervision of In-vivo dosimetry program	Weekly
2016 - 2018	Supervision of Patient QA program at UCSF	Weekly
2016 - 2018	Monthly and Annual Linac QA	Monthly/Annual
2016 - 2021	Daily Clinical tasks: Chart QA, Troubleshooting Linac issues, SDX support, 4D Support, Treatment planning support.	Daily

PROFESSIONAL ACTIVITIES

MEMBERSHIPS

2013 - present	American Association of Physics in Medicine
2013 - present	International Radiation Physics Society
2016 - present	European Society for Radio-Therapy

SERVICE TO PROFESSIONAL ORGANIZATIONS

2017 - present	GME Diversity Committee, UCSF	Member
2017 - present	Department of Defense Grant Reviewer	Reviewer
2017 - present	Diversity Committee, Radiation Oncology Department	Member
2017 - present	Resident Admission Committee, Radiation Oncology Department	Member
2023 - present	Task Group: Reducing Biases in Machine Learning Algorithms.	Chair

SERVICE TO PROFESSIONAL PUBLICATIONS

2014 - present	Reviewer for: Medical Physics Journal, International Journal of Radiation Oncology Biology Physics, Radiotherapy and Oncology Journal, European Journal of Medical Physics, Journal of Physics Medicine and Biology, British Medical Journal, Scientific Reports, Proceedings of the National Academy of Sciences
2018 - present	Associate Editor for the Medical Physics Journal
2019 - present	Co-chair of the Task Group : Effect of Biases on Machine Learning applications in Radio-Therapy. (American Association of Medical Physics)
2019 - present	Member of the American Association of Physics in Medicine Machine Learning Committee.
2019 - present	Member of the American Association of Physics in Medicine Outcome Committee.
2020 - present	Associate Editor for the British Journal of Radiology

INVITED PRESENTATIONS - INTERNATIONAL

2016	"Machine learning facilitates failure mode analysis and Virtual QA for IMRT." World Congress of Medical Physics. Canada	Speaker
2016	"Virtual IMRT QA Using Machine Learning: A Multi-Institutional Validation". AAPM Annual Conference.	Speaker

2016	"Factors Predictive of Chest Wall Syndrome in Patients With Stage I Non-Small Cell Lung Cancer Treated With Stereotactic Body Radiation Therapy". ASTRO	Speaker
2017	"Machine Learning-Based Enables Data-driven Radiotherapy Treatment Planning Decision Support". ESTRO	Speaker
2017	"Identifying Patients Who Benefit the Most from Salvage HDR Brachytherapy." ESTRO	Speaker
2017	"On the selection of classifiers for outcome prediction in radiotherapy". BIGART	Speaker
2017	"Interpretable and Accurate Models". USF Big Data Conference.	Invited Speaker
2017	"Interpretable Models in Radiation Oncology." Big Data Workshop. University of Michigan.	Invited Speaker
2017	"From Statistics to Machine Learning and back." SRS Annual Conference.	Invited Speaker
2018	"The Additive Tree." Big Data Workshop. University of Michigan.	
2018	"The Additive Tree." session: "Mathematical modeling in Cancer Therapy." AAPM Annual Conference	Invited Speaker
2018	"The Role of Machine Learning in Radiation Oncology." 3rd Heidelberg Ion Beam Symposium.	Invited Speaker
2019	"Machine Learning in Medical Physics. A roadblock is waiting." Maastricht University.	Invited Speaker
2021	"Survival Prediction of Cervix cancer patients treated with HDR". ESTRO. Madrid	Speaker
2022	"Expert Augmented Machine Learning". Australian National Medical Physics Conference	Keynote Speaker
2023	"Machine Learning in Radiotherapy" University of Favaloro, Buenos Aires, Argentina	Invited Speaker
2023	"Causality in Machine Learning", University of Michigan, Practial Big Data Workshop	Invited Speaker
2023	"Causality in Machine Learning", Heidelberg University, Germany	Invited Speaker
2023	"Machine Learning prediction of toxicity for NSCLC patients treated with proton therapy." PTCOG, Madrid	Invited Speaker

INVITED PRESENTATIONS - NATIONAL

2012	G.Valdes-Diaz and K S Iwamoto. Oral Presentation: "Effect of 5FU bolus injection as a radiosensitizer" RSNA, Chicago.	Speaker
2015	Memorial Sloan Kettering. Department of Medical Physics. "Machine Learning in Radiation Oncology: From QA to Outcome"	Speaker
2015	G Valdes, T. D Solberg, M. Heskel, L. Ungar, S. Charles II. "Using machine learning to predict radiation pneumonitis in patients with stage I non small cell lung cancer treated with stereotactic body radiation therapy."	Speaker
2015	G. Valdes, R. Scheuermann, M. Bellerive, A. Olszanski, C. Hung, T. D. Solberg "Cloosing the Loop on Virtual IMRT QA". AAPM National Meeting.	Speaker
2016	G Valdes, M Chan , R Scheuermann , J Deasy , T Solberg "Virtual IMRT QA Using Machine Learning: A Multi-Institutional Validation."	Speaker
2016	Patient Specific Clinical Decision Tool to Predict Radiation Pneumonitis After SBRT for Stage I NSCLC. G Valdes, T. D Solberg, M. Heskel, L. Ungar, S. Charles II	Speaker
2017	University of Michigan. "The need of interpretable models in medicine."	Speaker
2017	The Additive Tree. Berkeley Statistics Department.	
2017	The Additive Tree. Biostatistc Department. UC San Francisco.	Speaker
2018	Interpretability in Medicine. Stanford Radiation Oncology Department.	Speaker
2019	The Conditional Super Learner. Department of Biostatistics. UC Berkeley	Speaker
2019	Three approaches to Interpretability. Department of Data Science. Stanford	Speaker
2019	Expert Augmented Machine Learning. Radiation Oncology Department. UT Southwestern.	Speaker
2020	Representational Gradient Boosting. UCSF Department of Biostatistics	Speaker
2020	Representational Gradient Boosting, UC Berkeley Department of Biostatisitcs	Speaker
2021	Expert Augmented Machine Learning. Biomedical Department. University of Wahsington	Speaker

2021	Expert Augmented Machine Learning. Radiation Oncology Department. Massachusetts General Hospital. Harvard University	Speaker
2023	"Lockout: Sparse Regularization of Neural Networks", AAPM	Invited Speaker
2023	"Lockout: Sparse Regularization of Neural Networks", University of Pennsylvania	Invited Speaker
2023	"Lockout: Sparse Regularization of Neural Networks", AAAI Conference, Washington DC	Invited Speaker

UNIVERSITY AND PUBLIC SERVICE

SERVICE ACTIVITIES SUMMARY

At UCSF I have served as a member of the Diversity Committee at both his department and UCSF level. In this role, I have mentored undergraduate students from under-represented backgrounds to promote STEM careers. I am also an active member of American Association of Physics in Medicine (AAPM) and I hold board positions in the Outcome Committee and the Machine Learning Committee. Additionally I am an associate editor for the Journal of Medical Physics and the British Journal of Radiology. Finally I have been appointed as the chair of the clinical task group charge with developing recommendations to mitigate the effect of biases in the application of machine learning to radiotherapy.

UCSF CAMPUSWIDE

2017 - present	I have served actively in the UCSF GME Diversity Committee	Board Member

DEPARTMENTAL SERVICE

2016 - present	I have served actively in Diversity Committes in my department.	Board Member

COMMUNITY AND PUBLIC SERVICE

2011 - 2012	SACNAS Program, UCLA, 2011. Mentored two undergraduate minority students during the spring quarter of 2011. The objective of the program was to introduce undergraduate students to graduate school and to teach them how to critically read scientific papers.	Mentor
2011 - 2012	Biomedical Physics and STEM Pledge United initiative, 2009. Worked with high school students from Animo Charter High School, located in an unprivileged area of Los Angeles. Students were assisted with ideas and concepts for projects and preparing for the Science Fair.	Mentor

2011 - 2012	Board Member, Technical Entrepreneurial Community at UCLA (TEC), 2012. Organized several events across campus to foster entrepreneurship among students and make UCLA a more entrepreneurial university.	Board Member
2017 - present	GME Diversity Committe	Board Member
2017 - present	Department of Defense grant reviewer	Panel Member

CONTRIBUTIONS TO DIVERSITY

CONTRIBUTIONS TO DIVERSITY   Contributions to Diversity, Equity & Inclusion Guidance

Co-Chair of the Task Group: "Detecting and correcting biases in Machine Learning-based algorithms applied to Radiotherapy" to develop the clinical recommendations to implement quality assurance programs to mitigate, reduce and erradicate the effect of biases in the applications of ML to radiotherapy.

TEACHING AND MENTORING

TEACHING SUMMARY

During the last 10 years, I have taught at both Middle School and College Level. I have been an adjunct professor in public universities in two different countries, USA and Cuba. In both of them I have taught Thermodynamics. The courses that he has taught has always been in the intersection of Mathematics and Science. As such, I have paid particular attention to create both the technical skills and the scientific intuition that STEM students need to succeed in such courses. During my appointment as an assistant professor in the department of radiation oncology I have participated in the education and training of medical physics and medical residents. I currently lead the Patient specific QA rotation taught to first year physics residents. I also regularly teaches Machine Learning as part of the Machine Learning course initiated by the department of Epidemiology and Biostatistics. I am currently appointed as the lead professor in the course DATASCI 225: Advanced Machine Learning for Biomedical Sciences II that is taught every spring as part of the new Machine Learning Master Program created by the Epidemiology and Biostatistics department. Finally, I have served in the PhD committee for students from the Bio-engineering program.

FORMAL TEACHING

Not UCSF	Academic Yr	Course No. & Title	Teaching Contribution	School	Class Size
X	2006 - 2007	Thermodynamic	Lecturer		14
X	2013 - 2013	Thermodynamic	Lecturer		30
	2016 - 2020	Teaching Medical and Physics resident at the Radiation Oncology Department	Lecturer	Medicine	4/10
	2016 - 2020	Physics of Radiation Oncology	Lecturer	Medicine	10

Not UCSF	Academic Yr	Course No. & Title	Teaching Contribution	School	Class Size
	2019 - 2020	Introduction to Machine Learning	Lecture	Medicine	1
	2021 - present	DATASCI 225: Advanced Machine Learning for Biomedical Sciences II	Professor	Medicine	17

INFORMAL TEACHING

2007 - 2008 Middle Science School Teacher

MENTORING SUMMARY

I provide mentoring to medical and physics residents in the Department of Radiation Oncology. I teach theoretical and practical aspects of Radiation Oncology: Quality Assurance, Dosimetry, Treatment planning, Predictive Modeling.

POSTDOCTORAL FELLOWS AND RESIDENTS MENTORED

Dates	Name	Fellow	Mentor Role	Faculty Role	Current Position
2016 - 2017	Vasant Keanery		Research/Scholarly Mentor,Co-Mentor/Clinical Mentor	Mentor	Inustry
2017 - 2019	Efsthathios Gennatas		Research/Scholarly Mentor	Mentor	Assistant Professor, Department of Epidemiology and Biostatistics, UCSF
2018 - present	Tomi Nano		Co-Mentor/Clinical Mentor	Mentor	Assistant Professor, Department of Rad Onc, UCSF
2020 - present	Wilmer Arbelo		Research/Scholarly Mentor,Career Mentor	Mentor	Postdoctoral Fellow, Rad Onc, UCSF

RESEARCH AND CREATIVE ACTIVITIES

RESEARCH AND CREATIVE ACTIVITIES SUMMARY

The expanding collection and sharing of health-related data, increases in computational power, and advances in machine learning (ML) are hoped to enable discoveries of better ways to prevent, diagnose, and treat disease. In our field of Radiation Oncology, Machine Learning has been applied to outcome prediction, quality assurance, auto-segmentation and image registration, image classification, treatment planning and it is poised to become an indispensable tool in our daily clinical workflows. Despite new advances, Radiation Oncology has many specific challenges, ranging from unique and complex datasets with multiple source of information (e.g. comorbidities, 4DCT, CBCT, CT, dose, structures, setup and quality assurance or genetic information), limited clinical outcome data, lack of standard of care for many disease sites, interaction of radiation and chemotherapy, limited access to genomics data, and the presence of confounders in many of our clinical datasets. If we pair these challenges with suboptimal algorithms, the indiscriminate deployment of models developed can compromise medicine’s fundamental oath to primum non nocere. For instance, an artificial neural network (a non-interpretable algorithm) that was developed to triage patients with pneumonia for hospital discharge was found to inadvertently label asthmatic patients as low risk. Deploying this neural network could have had detrimental consequences for these patients but if an interpretable algorithm had been used this error could have been easily detected by physicians. Similar problems have been found for image classification tasks using deep learning giving a false sense of accuracy to physicians (e.g a model used the label “portable” on X-ray images to predict an increased risk of cardiomyopathy since patients that cannot move need to have the x-rays done at their beds). Therefore, to make ML part of everyday clinical practice in Radiation Oncology and Medicine at large, a critical challenge is to increase the robustness and transparency of the models developed. Equally important is to create a set of tools, commissioning procedures and a quality assurance program that could let us detect population shifts from the data used to train the algorithms or errors due to the presence of confounders. Towards achieving these goals, I would like to devote my scientific career. In that regard I have already made important contributions, both theoretical and practical, and continue to do so. **Theoretical Contributions:** In collaboration with Penn Computer Science Department and Stanford Statistics Department I developed MediBoost, an algorithm that improves the accuracy of the most popular decision tree algorithm (CART) while keeping its same topology and as such its interpretability. This algorithm was further extended in one of my hallmark publications to show how it unified two of the most popular frameworks to build ML models: CART and Gradient Boosting. This new framework was called “The Additive Tree” and due to its impact on accuracy and interpretability of decision trees, and the importance of the later in medicine, we belief that it opens a new era of research on Decision Tree algorithms. Additionally, in collaboration with the Berkeley Biostatistics and Statistics Department, I have developed the Conditional Interpretable Super Learner (CiSL), an algorithm that removes the topological constraints that interpretable algorithms have while still building a transparent mode (under preparation for submission). Further, in this work we show for the first time how it is possible to learn in the cross validation space and improve on widely popular techniques like stacking. We believe that CiSL, for its characteristics, is especially important for the analysis of structured clinical trial data and dynamic treatment allocation. Big part of my future intellectual activity will be dedicated to the application of CiSL to Radiation Oncology clinical trial to optimize treatment selection. Finally, I have led a team that have created the framework Expert Augmented Machine Learning (EAML), the first platform that effectively combine physicians and AI knowledge to improve over both. **Applied Contributions:** I have also been widely interested in the applications of Machine Learning for Quality Assurance (QA). In this sense, I have pioneered the use of predictive models for their application to QA in Radiation Therapy. Specifically, I was one of the first authors to apply Machine Learning to Quality Assurance data in Radiation Oncology with the goal to improve patient safety. I developed ML models that predicted errors on the imaging system on the Linacs, a key factor in the delivery of accurate radiation treatments . Additionally, I developed and validated the concept of Virtual IMRT QA, an application that enables safe pre-treatment radiation therapy plan verification. Virtual IMRT QA will play a key role in the safe introduction of Adaptiative Radiation Therapy, one of the frontiers for Radiation Therapy in the next decade. A good part of my applied research program is intended to the deployment of Virtual IMRT QA into clinical practice and enabling adaptative Radiation Therapy.

RESEARCH AWARDS - CURRENT

1. K08 EB026500-01A1	PI	80% % effort	Valdes (PI)
NIH		07/01/2019	07/01/2023
Development of Accurate and Interpretable Machine Learning Algorithms for their application in Medicine			
2. R01 HS27369-01	Co-Investigator	10% % effort	Auerbach (PI)
NIH		09/01/2019	08/31/2023
Utility of Predictive Systems to identify Inpatient Diagnostic Errors: The UPSIDE Study.			
In this grant we are using machine learning algorithms including Expert Augmented Machine Learning to determine the biggest factors driving diagnostic errors in medicine departments.			
I am the co-creator of Expert Augmented Machine Learning, a new algorithm that brings in prior clinical knowledge to build robust machine learning algorithms. Together with Dr Seagal I will lead the analysis of the data collected using Machine Learning			
3. 3K08EB026500-03S1 GRANT13628922	PI	80% % effort	Valdes (PI)
NIBIB		07/01/2022	06/30/2023
Development of Accurate and Interpretable Machine Learning Algorithms for their application in Medicine			
One year extension of K08 award			
I am the PI of this grant			

RESEARCH AWARDS - SUBMITTED

1. GRANT13795969	PI	40% % effort	Valdes (PI)
NCI		2023/09/01	2028/09/01
Causal estimation of the effect of pneumonitis/dyspnea and esophagitis/dysphagia after proton beam therapy on Overall Survival and Progression Free Survival for stage III thoracic cancer patients		$ 500,000 direct/yr 1	$ 2,500,000 total

Unresectable stage III NSCLC patients are managed today with chemoradiotherapy, followed by the consolidation drug Durvalumab if they have a good performance status within a month after the end of treatment. This strategy has proven to be very successful, increasing PFS to a median of 16.9 months from the previous 5.9 months. However, there is still room for improvement in the clinical outcomes for this patient population. In this sense, classical radiobiology considerations support the theory that radiation dose escalation (60 Gy vs. 74 Gy) will increase locoregional control and possibly reduce distant metastasis through the abscopal effect. However, two clinical trials, one with photons and one using proton scattering technologies, failed to result in improvements which was attributed to the "one-size-fits-all" approach overtreating normal tissue to maintain tumor coverage and increasing toxicities in the high dose branch. These high-grade toxicities (CTCAE v.4) require symptomatic intervention, affect patient quality of life, compromise treatment compliance, and potentially compromise OS and PFS due to their impact on the ability to thrive (up to 50% of lung cancer patients die of malnutrition). On the other hand, the adoption of proton pencil beam scanning technology offers renewed hope, as it results in better dose sculpting and organ sparing, but it can still lead to high-grade toxicities. Personalized dose escalation is thus crucial for realizing the potential of pencil beam scanning and achieving superior outcomes; a goal that cannot be achieved without identifying high-risk patients and quantifying the causal impact of toxicities on OS and PFS. Unfortunately, these tasks have been hampered by lack of data and confounding comorbidity scores, which can only be disentangled with adequate data and novel modeling methods. In collaboration with the Proton Collaborative Group (PCG), the proposed study leverages data from the NCT01255748 clinical trial to assemble the largest dataset of its type, comprising 17 institutions and 636 patients who underwent proton beam treatment for unresectable stage III NSCLC. The study also collects a rich set of information, including more than 137 dosimetric and clinical features, and uses machine learning (EAML) and causal inference analysis (TMLE, IPW, IV) to provide robust estimates of the probability of toxicities and their causal effect. Additionally, the study will extend EAML with a new methodology, Expert Augmented Survival Analysis (EASA), to identify unmeasured confounders and provide causal inference analysis for the unique outcomes under study (right-censored survival data). Extensive sensitivity analysis makes our conclusions robust to the assumptions made. The successful conclusion of this study holds the potential to revolutionize our understanding of toxicities and their effects, by enabling us to predict them before treatment, stablish their causal effect and implement a tailored dose escalation strategy. This will result in a remarkable improvement in outcomes and a significant enhancement in the quality of life for Stage III NSCLC patients, making a lasting impact on their health and well-being.

I will be the main PI of this grant.

RESEARCH AWARDS - PAST

1.	5018-134077-2012155-45	Principal Investigator	5 % effort % effort	Valdes (PI) (PI) (PI)
	University of California		07/2017	07/2020
	MediForests: Critical Independent Validation of Decision Support Systems in Medicine.			

In this grant we are testing an algorithm that will automatically extract knowledge from clinicians to validate Machine Learning algorithms before their deployment into clinical practice. Principal Investigator

As a principal investigator of this grant I am responsible for its completion.

PEER REVIEWED PUBLICATIONS

1. Valdés G, S. Rodríguez-Calvo, M. Rapado-Paneque, A. Pérez-Gramatges, F. A. Fernández, E. Frota, C. Ribeiro. Effects of gamma radiation on phase behaviour and critical micelle concentration of Triton X-100 aqueous solutions. Journal of Colloid and Interface Science. 2007; 311:253:261.
2. Valdés G, S. Rodríguez-Calvo, M. Rapado-Paneque, A. Pérez-Gramatges, F. A. Fernández, E. Frota, C. Ribeiro. Effects of gamma radiation on phase behaviour and critical micelle concentration of Triton X-100 aqueous solutions. Journal of Colloid and Interface Science. 2007; 311:253:261.
3. Valdés G, S. Rodríguez-Calvo, M. Rapado-Paneque, A. Pérez-Gramatges, F. A. Fernández, E. Frota, C. Ribeiro. Effects of gamma radiation on phase behaviour and critical micelle concentration of Triton X-100 aqueous solutions. Journal of Colloid and Interface Science. 2007; 311:253:261.
4. Valdés G, S. Rodríguez-Calvo, M. Rapado-Paneque, A. Pérez-Gramatges, F. A. Fernández, E. Frota, C. Ribeiro. Effects of gamma radiation on phase behaviour and critical micelle concentration of Triton X-100 aqueous solutions. Journal of Colloid and Interface Science. 2007; 311:253:261.
5. Valdés G, S. Rodríguez-Calvo, M. Rapado-Paneque, A. Pérez-Gramatges, F. A. Fernández, E. Frota, C. Ribeiro. Effects of gamma radiation on phase behaviour and critical micelle concentration of Triton X-100 aqueous solutions. Journal of Colloid and Interface Science. 2007; 311:253:261.
6. Valdés G, S. Rodríguez-Calvo, M. Rapado-Paneque, A. Pérez-Gramatges, F. A. Fernández, E. Frota, C. Ribeiro. Effects of gamma radiation on phase behaviour and critical micelle concentration of Triton X-100 aqueous solutions. Journal of Colloid and Interface Science. 2007; 311:253:261.
7. Valdés G, S. Rodríguez-Calvo, M. Rapado-Paneque, A. Pérez-Gramatges, F. A. Fernández, E. Frota, C. Ribeiro. Effects of gamma radiation on phase behaviour and critical micelle concentration of Triton X-100 aqueous solutions. Journal of Colloid and Interface Science. 2007; 311:253:261.
8. Valdés G, S. Rodríguez-Calvo, M. Rapado-Paneque, A. Pérez-Gramatges, F. A. Fernández, E. Frota, C. Ribeiro. Effects of gamma radiation on phase behaviour and critical micelle concentration of Triton X-100 aqueous solutions. Journal of Colloid and Interface Science. 2007; 311:253:261.
9. Valdés G, S. Rodríguez-Calvo, M. Rapado-Paneque, A. Pérez-Gramatges, F. A. Fernández, E. Frota, C. Ribeiro. Effects of gamma radiation on phase behaviour and critical micelle concentration of Triton X-100 aqueous solutions. Journal of Colloid and Interface Science. 2007; 311:253:261.
10. Valdés G, S. Rodríguez-Calvo, M. Rapado-Paneque, A. Pérez-Gramatges, F. A. Fernández, E. Frota, C. Ribeiro. Effects of gamma radiation on phase behaviour and

critical micelle concentration of Triton X-100 aqueous solutions. Journal of Colloid and Interface Science. 2007; 311:253:261.

11. Valdes G, Iwamoto KS. Re-evaluation of cellular radiosensitization by 5-fluorouracil: high-dose, pulsed administration is effective and preferable to conventional low-dose, chronic administration. Int J Radiat Biol. 2013 Oct; 89(10):851-62. PMID: 23607451

12. Valdes G, Schulte RW, Ostermeier M, Iwamoto KS. The high-affinity maltose switch MBP317-347 has low affinity for glucose: implications for targeting tumors with metabolically directed enzyme prodrug therapy. Chem Biol Drug Des. 2014 Mar; 83(3):266-71. PMID: 24131788

13. **Takahashi M*, Valdes G***, Hiraoka K, Inagaki A, Kamijima S, Micewicz E, Gruber HE, Robbins JM, Jolly DJ, McBride WH, Iwamoto KS, Kasahara N. Radiosensitization of gliomas by intracellular generation of 5-fluorouracil potentiates prodrug activator gene therapy with a retroviral replicating vector. Cancer Gene Ther. 2014 Oct; 21(10):405-410. PMID: 25301172. PMCID: PMC4246057 *** First author contribution.**

14. Valdes G, Robinson C, Lee P, Morel D, Low D, Iwamoto KS, Lamb JM. Tumor control probability and the utility of 4D vs 3D dose calculations for stereotactic body radiotherapy for lung cancer. Med Dosim. 2015; 40(1):64-9. PMID: 25542785

15. Valdes G, Morin O, Valenciaga Y, Kirby N, Pouliot J, Chuang C. Use of TrueBeam developer mode for imaging QA. J Appl Clin Med Phys. 2015 07 08; 16(4):322□333. PMID: 26219002. PMCID: PMC5690025

16. Valdes G, Solberg TD, Heskel M, Ungar L, Simone CB. Using machine learning to predict radiation pneumonitis in patients with stage I non-small cell lung cancer treated with stereotactic body radiation therapy. Phys Med Biol. 2016 08 21; 61(16):6105-20. PMID: 27461154. PMCID: PMC5491385

17. Valdes G, Scheuermann R, Hung CY, Olszanski A, Bellerive M, Solberg TD. A mathematical framework for virtual IMRT QA using machine learning. Med Phys. 2016 Jul; 43(7):4323. PMID: 27370147

18. Valdes G, Luna JM, Eaton E, Simone CB, Ungar LH, Solberg TD. MediBoost: a Patient Stratification Tool for Interpretable Decision Making in the Era of Precision Medicine. Sci Rep. 2016 Nov 30; 6:37854. PMID: 27901055. PMCID: PMC5129017

19. Valdes G, Lee C, Tenn S, Lee P, Robinson C, Iwamoto K, Low D, Lamb JM. The relative accuracy of 4D dose accumulation for lung radiotherapy using rigid dose projection versus dose recalculation on every breathing phase. Med Phys. 2017 Mar; 44(3):1120-1127. PMID: 28019649

20. Valdes G, Chan MF, Lim SB, Scheuermann R, Deasy JO, Solberg TD. IMRT QA using machine learning: A multi-institutional validation. J Appl Clin Med Phys. 2017 Sep; 18(5):279-284. PMID: 28815994. PMCID: PMC5874948

21. Valdes G, Simone CB, Chen J, Lin A, Yom SS, Pattison AJ, Carpenter CM, Solberg TD. Clinical decision support of radiotherapy treatment planning: A data-driven machine learning strategy for patient-specific dosimetric decision making. Radiother Oncol. 2017 Dec; 125(3):392-397. PMID: 29162279

22. Kearney V, Solberg T, Jensen S, Cheung J, Chuang C, Valdes G. Correcting TG 119 confidence limits. Med Phys. 2018 Mar; 45(3):1001-1008. PMID: 29360150

23. Valdes G, Chang AJ, Cunnan A, Solberg TD, Hsu IC, Interian Y, Owen K, Jensen ST, Ungar LH. In Reply to Gensheimer and Trister. Int J Radiat Oncol Biol Phys. 2018 12 01; 102(5):1594-1596. PMID: 31014789

24. Thompson RF, Valdes G, Fuller CD, Carpenter CM, Morin O, Aneja S, Lindsay WD, Aerts HJWL, Agrimson B, Deville C, Rosenthal SA, Yu JB, Thomas CR. The Future of Artificial Intelligence in Radiation Oncology. Int J Radiat Oncol Biol Phys. 2018 10 01; 102(2):247-248. PMID: 30191856

25. Feng M, Valdes G, Dixit N, Solberg TD. Machine Learning in Radiation Oncology: Opportunities, Requirements, and Needs. Front Oncol. 2018; 8:110. PMID: 29719815. PMCID: PMC5913324

26. Gennatas ED, Wu A, Braunstein SE, Morin O, Chen WC, Magill ST, Gopinath C, Villaneueva-Meyer JE, Perry A, McDermott MW, Solberg TD, Valdes G, Raleigh DR. Preoperative and postoperative prediction of long-term meningioma outcomes. PLoS One. 2018; 13(9):e0204161. PMID: 30235308. PMCID: PMC6147484

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1. Efstathios D Gennatas, Jerome H Friedman, Lyle H Ungar, Romain Pirracchio, Eric Eaton, Lara G Reichmann, Yannet Interian, José Marcio Luna, Charles B Simone, Andrew Auerbach, Elier Delgado, Mark J van der Laan, Timothy D Solberg, Gilmer Valdes. **Expert-augmented machine learning.** PNAS first published February 18, 2020 https://doi.org/10.1073/pnas.1906831117

   Role: One of the dogmas of Machine Learning is that the data will sort itself out and powerful algorithms will find the truth provided with enough data. In this article, I lead a team that proved that this dogma is incorrect and that Machine Learning algorithms and human experts, specifically physicians, learn complementary knowledge. Additionally, we created the first platform that effectively combines physicians' and AI knowledge for the benefit of our patients.

2. Valdes, G, Interian Y, Gennatas S, Van der Laan M, **"The Conditional Super Learner"** IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE, VOL. 44, NO. 12, DECEMBER 2022

   Role: Using cross validation to select the best model from a library is standard practice in machine learning. Similarly, meta learning is a widely used technique where models previously developed are combined (mainly linearly) with the expectation of improving performance with respect to individual models. In this article we consider the Conditional Super Learner (CSL), an algorithm that selects the best model candidate from a library of models conditional on the covariates. The CSL expands the idea of using cross validation to select the best model and merges it with meta learning. We propose an optimization algorithm that finds a local minimum to the problem posed and proves that it converges at a rate faster than o(N^1/4) . We offered empirical evidence that: (1) CSL is an excellent candidate to substitute stacking and (2) CLS is suitable for the analysis of Hierarchical problems. Additionally, implications for global interpretability are emphasized.

3. Luna JM, Gennatas ED, Ungar LH, Eaton E, Diffenderfer ES, Jensen ST, Simone CB, Friedman JH, Solberg TD, Valdes G. **Building more accurate decision trees with the additive tree.** Proc Natl Acad Sci U S A. 2019 Oct 01; 116(40):19887-19893. PMID: 31527280. PMCID: PMC6778203

   Role: Classification and Regression Trees (CART) and Gradient Boosting are two of the most important Machine Learning algorithms developed up to date. In this theoretical work, we showed how these two algorithms exist in a continuum. Besides the theoretical implication of this work, these results allowed us to develop a single decision tree algorithm, The Additive Tree, that significantly improved over CART while maintaining its interpretability. This work, therefore, will facilitate the safe adoption of artificial intelligence in medicine and its acceptance by physicians.

4. G. Valdes, R. Scheuermann, M. Bellerive, A. Olszanski, C. Hung, T. D. Solberg. **A mathematical framework for virtual IMRT QA using machine learning.** Med. Phys. Vol 43, 7, 4323-4334. 2016

   Role: As firth author contribution we developed the first system that uses Machine Learning to predict Quality Assurance metrics in Radiation Oncology, Virtual IMRT QA. This algorithm could save precious time in the treatment of patients with radiation as well as allow for the introduction of Adaptative Radiation Therapy.

5. G Valdes, R. Schulte, M Ostermeier, K S Iwamoto. **The High-affinity Maltose Switch MBP317-347 has Low Affinity for Glucose: Implications for Targeting Tumors with Metabolically-Directed Enzyme Prodrug Therapy.** Chem Biol & Drug Design. 83(3):266-71, 2014. (COVER OF MARCH ISSUE).

   Role: As the first author in collaboration with a multidisciplinary team we developed the concept of Metabolic Directed Enzyme Prodrug Therapy which takes advantages of low sensitivity switches, instead of high sensitivity, to target tumor cells based on their energetic needs. This paper was featured as the cover paper of the March edition by the journal Chem Biol & Drug Design.

PATENTS ISSUED OR PENDING

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2. G. Valdes, R. Scheuermann, M. Bellerive, A. Olszanski, C. Hung, T.D. Solberg. "Virtual IMRT QA". US Patent: 62/139,864. 2017