

Education

M.S. in Computer Science

UNIVERSITÉ LAVAL, IN COLLABORATION WITH ADOBE

Québec, Canada

Aug. 2021 - Present

- **Thesis:** Robust Shadow Composition to Photorealistically Insert Virtual Objects in Real Scenes
- **Advisor:** Jean-François Lalonde

GPA: 4.33/4.33 (current)

Bachelor of Computer Science

UFPE (FEDERAL UNIVERSITY OF PERNAMBUCO)

Recife, Brazil

Mar. 2016 - May 2021

- **Thesis:** Real-Time 6DoF Tracking of Rigid 3D Objects Using a Monocular RGB Camera

Research Experience

MIT Summer Geometry Institute

SGI FELLOW

Remote

Jul. 2021 - Aug. 2021

Summer program at MIT that introduces students to research in geometry processing. Remote in 2021 due to COVID-19. Projects were developed in groups of 3 students and 1 expert mentor.

Research Projects

- **Incompressible Flow on Meshes:** created an algorithm that performed incompressible Eulerian fluid simulations in 3D over triangular meshes without needing to use subdivision surfaces, based on Jos Stam's 2D algorithm. The core idea of the method consisted of diffusing quantities at barycenters and advecting by walking the geodesics on the surface of the meshes, considering gravity.
- **Self-Similarity Loss for Shape Descriptor Learning in Correspondence Problems:** applied different loss functions to improve the learning of deep functional maps between 3D shapes by minimizing the impact of symmetries.
- **Subdivision Surface Fitting:** minimized the visual difference between a low-poly 3D mesh (after subdivision) and a target high-poly one through gradient descent over an adapted distance function. Subdivisions implemented were Catmull-Clark for quad-meshes and Loop for triangular.

Voxar Labs

RESEARCH ASSISTANT

Recife, Brazil

Jan. 2018 - Apr. 2021

Lab at UFPE that works with AR, VR, computer vision, image processing, artificial intelligence, robotics, and HCI.

Collaboration with HP Inc. (under NDA)

- **HP Expressive Avatars (Oct. 2020 - Feb. 2021):** systematic literature reviews on real-time human interaction augmentation and prototyping end-to-end pipelines.
- **HP Federated Learning (Mar. 2020 - Jul. 2020):** academic writing on federated learning.
- **HP Nonflat AR (Jan. 2018 - Mar. 2020):** systematic literature reviews on real-time AR, replicating state-of-the-art academic papers, prototyping original ideas, and academic writing.

Teaching Experience

UFPE (Federal University of Pernambuco)

TEACHING ASSISTANT

Recife, Brazil

Aug. 2016 - Jul. 2019

- **Virtual and Augmented Reality (Jan. 2019 - Jul. 2019):** about 20 students, undergraduate as well as M.Sc. and Ph.D.
- **Graphics Processing (Aug. 2018 - Jul. 2019):** about 100 undergraduate students.
- **Linear Algebra and Analytic Geometry (Aug. 2016 - Jan. 2018):** over 200 undergraduate students.
- **Algorithms and Data Structures (Jan. 2017 - Jul. 2017):** about 50 undergraduate students.

Capacitação em Informática Básica (Basic IT Training)

VOLUNTEER TEACHER AND ORGANIZER

Recife, Brazil

Sep. 2016 - Jan. 2018

As a member of UFPE's PET program, regularly organized and taught basic IT courses to the local community for free. Over 150 total students. Contents included internet fundamentals, Google Drive, Microsoft Word, PowerPoint, Excel, and Windows 7.

Sigtunaskolan Humanistiska Läroverket (SSHL)

VOLUNTEER PROGRAMMING LOGIC TEACHER

Sigtuna, Sweden

Jan. 2014 - Apr. 2014

Part of the CAS component of the International Baccalaureate Diploma. Programming logic course taught in C/C++ to about a dozen students.

Organization and Service

MIT Summer Geometry Initiative

STUDENT VOLUNTEER

Remote

Jul. 2022 - Aug. 2022

At SGI 2022 my role is to assist fellows in their research projects and in learning technical and theoretical geometry processing topics.

IEEE ISMAR (International Symposium on Mixed and Augmented Reality)

STUDENT VOLUNTEER

Remote

2020

Acted as a moderator for paper sessions and keynotes, providing support to session chairs and taking questions from the audience. When sessions were not taking place, helped attendees throughout the virtual campus with information or tech support (as needed).

Hosted and managed the streaming backstage of sessions and helped session chairs guide presenters during SIBGRAPI (Brazilian Conference on Graphics, Patterns and Images) and SBGames (Brazilian Symposium on Computer Games and Digital Entertainment).

PET Informática

PET is the Brazilian government's special training program for high-achieving students. It has three pillars: teaching, research, and extension.

- **Blood donation organization** with HEMOPE (blood donor center of the state of Pernambuco). Over **300** donations.
- **Olympiad organization and graphic design**: 2016 and 2017 editions of OPEI (Informatics Olympiad of Pernambuco). Over **740** participants.

Publications

The Impact of Domain Randomization on Cross-Device Monocular Deep 6DoF Detection

2022

K. CUNHA, C. BRITO, **L. VALENÇA**, L. FIGUEIREDO, F. SIMÕES, V. TEICHRIEB

Pattern Recognition Letters

Invited extension of the SIBGRAPI 2020 best-paper on domain randomization. More comprehensive evaluation on different cameras and challenges. Over **110,000** annotated frames (**65,000** real and **45,000** synthetic) made available.

- **Personal contributions**: capturing sequences; creating tools to automatically render, segment, perform domain randomization, and annotate the 6DoF poses of real and synthetic frames; re-writing and formatting the original manuscript draft; design of pictures, charts, and diagrams.
- **Availability**: [full paper](#) on the Elsevier ScienceDirect digital library, [dataset](#) on GitHub.

Real-Time Monocular 6DoF Tracking of Textureless Objects using Photometrically-Enhanced Edges

2021

L. VALENÇA, L. SILVA, T. CHAVES, A. GOMES, L. FIGUEIREDO, L. COSSIO, S. TANDEL, J. LIMA, F. SIMÕES, V. TEICHRIEB

VISAPP 2021 - 16th International Conference on Computer Vision Theory and Applications

Novel, real-time 6DoF monocular RGB tracking approach aimed at textureless, pigmented objects. It achieved state-of-the-art precision (as of 2020) while having an orders-of-magnitude-smaller memory footprint and faster runtime. It was the only one in its category shown to work on mobile devices as well as desktop. A qualitative dataset with challenging scenes for textureless objects was also proposed.

- **Personal contributions**: literature review; conception and implementation; evaluations; paper writing; design of pictures and charts.
- **Availability**: [full paper](#) on the SciTePress digital library, [preprint](#) on ResearchGate, [demo video](#) on YouTube, [dataset](#) on GitHub.

A Study on the Impact of Domain Randomization for Monocular Deep 6DoF Pose Estimation

2020

K. CUNHA, C. BRITO, **L. VALENÇA**, F. SIMÕES, V. TEICHRIEB

SIBGRAPI 2020 - 33rd Brazilian Conference on Graphics, Patterns and Images

This work evaluated how different physical cameras behaved under different challenges (e.g., illumination changes and occlusion) when using deep learning to perform 6DoF detection of a textureless object. Training varied between using real and synthetic sequences with domain randomization. All annotated synthetic and real datasets were made public.

- **Best Paper Award - Main Track**: invited for an extended version on the Elsevier *Pattern Recognition Letters* journal.
- **Personal contributions**: capturing sequences; creating tools to automatically render, segment, perform domain randomization, and annotate the 6DoF poses of real and synthetic frames; re-writing and formatting the original manuscript draft; design of pictures, charts, and diagrams.
- **Availability**: [full paper](#) on the IEEE Xplore digital library, [preprint](#) on ResearchGate, [demo video](#) on YouTube, [datasets](#) on GitHub.

GoThrough: a Tool for Creating and Visualizing Impossible 3D Worlds Using Portals

2020

L. SILVA, **L. VALENÇA**, A. GOMES, L. FIGUEIREDO, V. TEICHRIEB

SBGames 2020 - 19th Brazilian Symposium on Computer Games and Digital Entertainment

Public tool for Unity that enabled the user to easily create 3D scenes with rectangular portals. The paper also contained a brief history of portals, described implementation details, outlined pitfalls, and provided an evaluation of isolated aspects, both human and technical.

- **2nd Best Paper Award - Computing Track**: invited for an extended version on the Elsevier *Entertainment Computing* journal.
- **Personal contributions**: literature review; elaboration and execution of evaluations; paper co-writing; design of pictures, charts, and diagrams.
- **Availability**: [full paper](#) on the IEEE Xplore digital library, [preprint](#) on ResearchGate, [oral presentation](#) on YouTube, [code](#) on GitHub.

Patents

Read Curved Visual Marks

US20210303957A1

LUCAS FIGUEIREDO, JOÃO TEIXEIRA, JOÃO PAULO LIMA, LUCAS MAGGI, THIAGO CHAVES, FRANCISCO SIMÕES, **LUCAS VALENÇA**, VERONICA TEICHRIEB, LUCIO COSSIO

Algorithm that uses a monocular RGB camera to identify 2D marks (such as QR codes) wrapped around non-planar surfaces by fitting a 3D mesh. Document [available](#) on Google Patents.

Neural Networks to Provide Images to Recognition Engines

WO2021126268A1

THIAGO SOUZA, FRANCISCO SIMÕES, THIAGO CHAVES, HEITOR FELIX, **LUCAS VALENÇA**, KELVIN CUNHA, RAFAEL ROBERTO, JOÃO TEIXEIRA, JOÃO PAULO LIMA, VERONICA TEICHRIEB, LUCIO COSSIO

Algorithm that utilizes neural networks to perform steganography, hiding visual marks within normal images with print-scan resilience.

Document [available](#) on Google Patents.

Selected Unpublished Works

Inertia

A technique that uses face tracking and IMU sensors to severely alleviate car sickness. User testing was halted due to the COVID-19 pandemic.

Page Turner

An Android tablet application that uses real-time RGB face and head tracking to enable musicians to turn sheet music without needing to stop playing. User testing was halted due to COVID-19. To be released for free as soon as testing is concluded.

Other Software Projects

- ShapeNet Blender** Fix for the two-sided BSDF materials of ShapeNet objects in Blender's Cycles engine.
- Projective Fix** Tool that applies a homography to a projector's output, rectifying it. Written in OpenCV w/ C++.
- CUDA Path Tracing** Monte Carlo path tracer from Peter Shirley's ray tracing books adapted to CUDA C. Interactive FPS for simple scenes.
- CAGD Header** Implementations of Catmull-Clark and Loop subdiv., NURBS, Catmull-Rom, Bézier w/ De Casteljau and Bernstein.
- CaLib** UI tool that facilitates live checkerboard camera calibration. Written in OpenCV w/ C++.
- Haskell Invaders** Space Invaders-inspired game written in Haskell.

Languages

Portuguese	Native	Preferred Languages	C/C++, Python, MATLAB, Java
English	Fluent	Libs and Frameworks	OpenCV, CUDA, PyTorch, Blender scripting, OpenGL, gptoolbox, Android NDK
Spanish	Advanced	Development Tools	CMake, Visual Studio, Docker, Git, SSH, Bash, PowerShell, \LaTeX
French, Swedish	Beginner	Multimedia Tools	Photoshop, Illustrator, Premiere Pro, Blender, MeshLab

Selected Skills and Software

Honors, Awards and Scholarships

2022	Research Proposal Scholarship , Introduction to Research course (IFT-6001), Université Laval	CAD\$ 650
2021 - 2022	Scholarship of Excellence , l'Institut Intelligence et Données (IID), Université Laval	approx. CAD\$ 20,000
2020	Best Paper Award , Brazilian Symposium on Computer Graphics and Image Processing (SIBGRAPI)	
2020	Best Paper (Runner Up) Award , Brazilian Symposium on Games and Digital Entertainment (SBGames)	

Certificates

2020	TOEFL iBT (Home Edition) - Score 119 out of 120 , Educational Testing Service (ETS)	Remote
2020	Fundamentals of Accelerated Computing with CUDA C/C++ , NVIDIA Deep Learning Institute	NVIDIA GTC, Remote
2020	Fundamentals of Accelerated Computing with CUDA Python , NVIDIA Deep Learning Institute	NVIDIA GTC, Remote
2020	Fundamentals of Deep Learning for Multi-GPUs , NVIDIA Deep Learning Institute	NVIDIA GTC, Remote
2020	Fundamentals of Deep Learning , NVIDIA Deep Learning Institute	NVIDIA GTC, Remote
2016	C Programming Language , Integrated Center of Information Technology (Citi)	Recife, Brazil
2016	Django Framework , Integrated Center of Information Technology (Citi)	Recife, Brazil
2012	Advanced Java Programming , Qualiti Software Processes	Recife, Brazil
2012	Basic Java Programming , Qualiti Software Processes	Recife, Brazil
2012	Programming Logic , Qualiti Software Processes	Recife, Brazil