

Teofilo de Campos

<http://www.teodecampos.github.io>

Interested in a wide range of topics related to Machine Learning and applications to Computer Vision and Natural Language Processing. Wide portfolio of research experience both in academia and industry in the fields of object detection and recognition, multimodal video analysis, 3D tracking, image processing and in the combination of vision and natural language.

Education

University of Oxford (2001 – 2006)

<http://www.robots.ox.ac.uk/~teo/thesis/>

DPhil (PhD) in Information Engineering

Supervisor: Prof. David W. Murray

Thesis title: 3D Visual Tracking of Articulated Objects and Hands

Other contributions: Hand and Hand Tracking from Wearable Robots.

University of São Paulo (USP), Brazil (1999 – 2001)

<http://vision.ime.usp.br>

M.Sc. in Computer Science

Supervisor: Prof. Roberto M. Cesar-Jr

Thesis title: Advances on Feature Selection Techniques with Applications to Face Recognition

Ranked within the top 10% best students of the department in 2001.

São Paulo State University (UNESP), Brazil (1995 – 1998)

B.Sc. in Computer Science

Scientific Initiation Project: Hardware of a Building Access Control System

Ranked as the 4th best student of the class.

Ranked 24th out of 1125 candidates in the admissions exam.

Professional experience

Vicon Motion Systems, Oxford (June 2021 – present)

<https://www.vicon.com>

Job title: Computer Vision / Deep Learning Scientist

Pioneering the use of Deep Learning techniques in Vicon's portfolio.

Playing a role in datasets creation and technical leadership.

Programming skills: Python, C++, PyTorch and other tools to develop ML systems.

University of Brasília (July 2016 – present)

<http://www.unb.br>

Professor at the Department of Computer Science (taking a leave of absence since June 2021)

Research projects while at Brasilia:

- KnEDLe: kNnowledge Extraction from Documents of LEgal content (2019–2022), as principal investigator, leading more than 20 people.
- Image and Video compression using deep learning, sponsored by Samsung (2019–2020)
- Victor Project: document classification for Brazil's supreme court (2018–2019).

Teaching experience:

- Computer Vision
- Algorithms and Computer Programming
- Experimental Physics
- Object Oriented Programming
- Advanced Software Development

Student supervision:

- Patricia Drumond, PhD student (2019–present) on Document Intelligence.
- Aloisio Dourado Neto, PhD student (2018–2022) on 3D semantic scene completion.
- Lindeberg Leite, PhD student (2020–present) on the use of language models for bioinformatics.
- Luciano Cejnog, PhD student (co-supervision since 2017) on 3D hand tracking for occupational therapy.
- Patricia Medyna, PhD student (2019–2021) on text mining.
- Frederico Guth, MSc student (2019–2022) on transfer learning.
- Pedro Henrique Luz de Araujo, MSc student (2019–2021) on document classification.
- Tiago Gallo, final year UG student (2018–2019) and MSc student (2020–2022) on person re-identification.
- Raphael Soares, final year UG student (2019) on image compression.
- Guilherme Lopes, final year UG student (2019) on semantic scene completion.
- Andre Guedes, final year grad student (2016–2017) on gesture recognition and then on semantic scene completion.

University of Surrey

(July 2009 – June 2016)

<http://www.ee.surrey.ac.uk/CVSSP/>

Senior Research Fellow (RA-II), Centre for Vision Speech and Signal Processing.

Research projects while at Surrey:

- S3A (2014–2019): *Future Spatial Audio for an Immersive Listener Experience at Home*, an EPSRC (EP/L000539/1) project lead by Prof Adrian Hilton, with partners at the BBC and the Universities of Southampton and Salford.
Main role: lead the computer vision aspects of this project, such as head tracking, audio-visual tracking and 3D scene analysis in order to model listeners and room acoustics for robust spatial audio in unconstrained environments.
Student co-supervision:
 - Sam Fowler, PhD student (2015–2016) on 3D scene analysis.
 - Estephan Dazzi-Wandekoken, visiting PhD student (2014–2015), on object matching using key-graphs.
- UGPN and Surrey-FAPESP projects (2014–2019): *Hand Tracking for Occupational Therapy*
Role: coordinate exchanges between the University of Surrey and the University of São Paulo to develop further collaborations.

- ACASVA (2009-2014): *Adaptive Cognition for Automated Sports Video Annotation*, an EPSRC (EP/F069421/1) project lead by Prof Josef Kittler.
Main research contributions: anomaly detection, action recognition, multimodal video analysis.
Student supervision: Nazli Faraji-Davar, PhD student (2010-2015) on Transductive Transfer Learning.
- PASCAL2 (2009-2013): *Pattern Analysis, Statistical Modelling and Computational Learning*, Network of Excellence funded by the European Union.
Role: Surrey's local manager (**principal investigator**).

University of Sheffield

(March 2013 – April 2014)

<http://sheffieldml.github.io>

Research Fellow (80% part-time), Machine Learning group, Sheffield Institute for Translational Neuroscience (SITraN).

Main research project: Synergy – systems approach to gene regulation biology through nuclear receptors, a BBSRC (UK) research project lead by Prof Neil Lawrence, in collaboration with the ERASysBio project (EU/FP7).

Main contribution: modelling mitosis from histopathological images of breast cancer tissue.

Uana Tech

(December 2010 – February 2012)

<http://personal.ee.surrey.ac.uk/Personal/T.Decampos/Uana/>

Co-founder (with Prof Lucia Specia) and R&D manager in Computer Vision.

Uana was a start-up company based in São Paulo, Brazil, focused on developing systems and services that are based on the application of computer vision and natural language processing to commercial problems.

Flagship project: textual and visual plagiarism detector.

Xerox Research Centre Europe (now Naver Labs Europe)

(January 2008 – July 2009)

<https://europe.naverlabs.com>

Research engineer, Textual and Visual Pattern Analysis group

Main research project: PinView *Personal Information Navigator through VIEWing*, a European Union FP7 project.

Role: main investigator of the work package on image categorisation. This work generated 3 international patents. Student supervision: Julian McAuley, visiting PhD student (2009) on structured learning for image segmentation.

Microsoft Research India

(February 2007 – August 2007)

<http://research.microsoft.com>

Research intern, mentored by Dr. Manik Varma in the Digital Geographics Group, managed by Dr Kentaro Toyama.

Contribution: built the Chars74K dataset and benchmarked a range of algorithms for character recognition from natural scenes containing text in English and Kannada. Used in more than 157 research papers.

Sharp Laboratories of Europe

(November 2005 – January 2007)

<http://www.sle.sharp.co.uk>

Research scientist in the Optical Imaging and Display Systems Department (the group that developed the first 3D LCD displays in the 90's), managed by Dr Graham Jones.

Main contributions in the fields of LED backlight control for high dynamic range TVs; image subpixel filtering to minimize leak in multiple view displays. Also contributed as part of the futurology work group.

Other relevant information

Awards

- Outstanding reviewer, International Conference on Computer Vision (ICCV), 2017.
- Best student paper award at VISAPP 2020, for my MSc student Tiago de Carvalho Gallo Pereira [23].
- Best MSc dissertation award, Brazilian Computer Society (SBC), 2002.
- Best paper awards at ICoFCS 2018 [36] and ICoFCS 2019 [29].

Program committees and conferences

Thesis committee

Examiner of PhD theses:

- Dr Helard Alberto Becerra Martinez, University of Brasilia, 8 February 2019.
Supervisor: Prof Mylène Farias
title: “Three-layer system for artifact classification and audio-visual quality assessment”
Other examiners: Prof Eduardo Peixoto (UnB), Prof Alexandre Pohl (UFPR).
- Dr Estephan Dazzi Wandekoken, University of São Paulo, 8 June 2015.
Supervisor: Prof Roberto Marcondes Cesar Jr.
Other examiners: Prof Carlos Hitoshi Morimoto (IME-USP), Prof Paulo André Vechiatto de Miranda (IME-USP), Prof Hélio Pedrini (UNICAMP).
- Dr Glenn Sheasby, Oxford Brookes University, 19 March 2013.
Supervisor: Prof Phil Torr
Other examiners: Prof David Duce (internal), Dr Mark Bishop from Goldsmiths University (independent chair).

Examiner of MSc theses:

- William Marques Dias, Universidade Estadual de Campinas, 02 October 2020.
Title: “Cross-dataset emotion recognition from facial expressions through convolutional neural networks”
Supervisor: Prof Anderson de Rezende Rocha (IC, Unicamp)
Other examiner: Paula Dornhofer Paro Costa (FEEC, Unicamp).
- Lucas Oliveira Souza, University of Brasilia, 15 February 2019.
Title: “Accelerating Learning in Multiagent Domains through Experience Sharing”
Supervisor: Prof Celia Ghedini Ralha (UnB)
Other examiner: Prof Anna Helena Reali Costa (Poli, USP).

Conference organisation/chairing

BMVC 2021 - 2023 – Area chair.

SIGBRAPI 2020 – Tutorials chair. Selected tutorials: (1) Faria and Carneiro, A survey on GANs; (2) Cordeiro and Carneiro, Deep Learning with Noisy Labels.

WACV 2017 – I served as an **area chair** in WACV, the IEEE’s and PAMI-TC’s premier meeting on applications of computer vision.

Gaussian Processes Schools – I have helped with the organisation of the GP Summer School in July 2013 and the GP Winter School in January 2014, both hosted at the University of Sheffield (<http://ml.dcs.shef.ac.uk/gpss/>). In both cases, I helped with local arrangements and by guiding students in the laboratory classes.

BMVC 2012 – British Machine Vision Conference: I have ran the students workshop (both as the program chair and the local organiser) and I have been helping with the local arrangements of the main conference.

VISAPP 2012 – International Conference on Computer Vision Theory and Applications: I have served as an area chair and I have dealt with 71 papers.

EURO 2012 – 25th European Conference on Operational Research: I have chaired two Computer Vision sessions in the Machine Learning stream.

ICCV 2007 – International Conference on Computer Vision: I served as a registration desk officer and helper.

ICPR 2004 – International Conference on Pattern Recognition: I served as a general helper.

SEMACE 1997 – VIII Computer Science Week: I served as a member of the organizing committee, held at IBILCE-UNESP, Brazil.

Peer reviewing

I am a registered reviewer for these **journals**:

- IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI), Since May 2017.
- Signal Processing: Image Communication (Elsevier), since September 2019.
- Journal of Machine Learning Research (JMLR, MIT), since November 2012.

- IEEE Transactions on Image Processing (TIP), since June 2003.
- IEEE Transactions on Signal Processing, since December 2004.
- IEE Proceedings Vision, Image & Signal Processing, since June 2004.
- Computer Vision and Image Understanding (CVIU, Elsevier), since October 2012.
- Image and Vision Computing (IVC, Elsevier), since June 2004.
- Pattern Recognition (PR, Elsevier), since 2006.
- Pattern Recognition Letters (PRL, Elsevier), since May 2005.
- International Journal of Machine Learning and Cybernetics (Springer), since December 2011.
- IEE Electronic Letters, since September 2004.
- World Scientific International Journal of Image and Graphics in 2006.

I have served as a program committee member in these **conferences**: CVPR 2008–2019 and 2021, ICCV 2009–2019, ECCV 2008–2020, NIPS 2014–2015, BMVC 2015–2020, AAI 2019, ACCV 2010–2018, ICPR 2010–2016 and 2020, VISAPP 2006–2011, SIBGRAPI 2002–2010, ISSPA 2003, WAICV/IBERAMIA/SBIA 2000, W Parts and Attributes/ECCV 2010–2012, W Visual Analysis Beyond Semantics/CVPR 2013.

Publications

- [1] P. H. Luz de Araujo, A. P. G. de Almeida, F. Ataide Braz, N. Correia da Silva, F. de Barros Vidal, and T. E. de Campos. Sequence-aware multimodal page classification of brazilian legal documents. *International Journal on Document Analysis and Recognition (IJ DAR)*, 26:33–49, 2023. <https://doi.org/10.1007/s10032-022-00406-7>. Preprint available from <https://arxiv.org/abs/2207.00748>, source code and dataset available from <https://teodecampos.github.io/ViP/1rec/>.
- [2] P. M. L. de Lucena Drumond, L. P. Leite, T. E. de Campos, and F. A. Braz. LayoutQT - layout quadrant tags to embed visual features for document analysis. *Engineering Applications of Artificial Intelligence*, 122:106091, 2023. <https://doi.org/10.1016/j.engappai.2023.106091>. Code available from <https://teodecampos.github.io/patricia/>.
- [3] A. Dourado Neto. *Towards Complete 3D Indoor Scene Understanding from a Single Point-of-View*. PhD thesis, Universidade de Brasilia, Brasilia-DF, Brazil, October 11 2022. Supervised by Teófilo de Campos, available from <https://teodecampos.github.io/aloisio/>.
- [4] A. Dourado, F. Guth, and T. de Campos. Data augmented 3D semantic scene completion with 2D segmentation priors. In *Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision (WACV)*, pages 3781–3790, January 2022. Source code available from <https://teodecampos.github.io/aloisio/>.
- [5] T. de CG Pereira and T. E. de Campos. Learn by guessing: Multi-step pseudo-label refinement for person re-identification. In *17th International Conference on Computer Vision Theory and Applications (VISAPP)*, pages 484–493, 2022. Preprint available from <https://arxiv.org/abs/2101.01215>.
- [6] T. de Carvalho Gallo Pereira. Unsupervised domain adaptation for real world person re-identification. Master’s thesis, Universidade de Brasilia, April 12 2022. Supervised by Teofilo E. de Campos. Available from <https://teodecampos.github.io/tiago/>.
- [7] T. d. C. Pereira and T. E. de Campos. Domain adaptation for person re-identification with part alignment and progressive pseudo-labeling. *International Journal of Pattern Recognition and Artificial Intelligence (IJPRAI)*, 35(16):2160014, 2021. DOI: <https://doi.org/10.1142/S0218001421600144>.
- [8] T. d. C. Pereira and T. E. de Campos. Domain adaptation for person re-identification on new unlabeled data using AlignedReID++. Technical Report arXiv:2106.15693, Cornell University Library, 2021. <https://arxiv.org/abs/2106.15693>. Project webpage: <https://teodecampos.github.io/tiago/>.
- [9] P. H. Luz de Araujo. Domain-specific datasets for document classification and named entity recognition. Master’s thesis, Universidade de Brasilia, July 2021. Supervised by Teofilo E. de Campos. Related resources available from <https://teodecampos.github.io/peluz/>.

- [10] H. Kim, L. Remaggi, A. Dourado, T. E. de Campos, P. Jackson, and A. Hilton. Immersive audio-visual scene reproduction using semantic scene reconstruction from 360 cameras. *Virtual Reality (VIRE)*, 26:823–838, 2021. DOI: <https://doi.org/10.1007/s10055-021-00594-3>.
- [11] A. Dourado, T. E. de Campos, H. Kim, and A. Hilton. EdgeNet: Semantic scene completion from a single RGB-D image. In *Proceedings of the 25th International Conference on Pattern Recognition (ICPR)*, Milan, Italy (online), January, 10–15 2021.
- [12] A. Dourado, F. Guth, T. de Campos, and L. Weigang. Domain adaptation for holistic skin detection. In *34th Conference on Graphics, Patterns and Images (SIBGRAPI)*, pages 362–369. IEEE, 2021. DOI: <https://doi.org/10.1109/SIBGRAPI54419.2021.00056>, Preprint available from <https://arxiv.org/abs/1903.06969>. Source code available from <https://teodecampos.github.io/aloisio/>.
- [13] L. W. X. Cejnog, T. E. de Campos, V. M. C. Elui, and R. M. Cesar-Jr. A framework for automatic hand range of motion evaluation of rheumatoid arthritis patients. *Informatics in Medicine Unlocked*, 23:100544, 2021. DOI:<https://doi.org/10.1016/j.imu.2021.100544>. Project webpage: <http://vision.ime.usp.br/~cejnog/handanalysis/>.
- [14] T. M. Borges, T. E. de Campos, and R. de Queiroz. Towards robustness under occlusion for face recognition. Technical Report arXiv:2109.09083, Cornell University Library, 2021. <https://arxiv.org/abs/2109.09083>.
- [15] T. F. Pereira, L. G. C. Fonseca, M. S. V. de Oliveira, T. E. Campos, and V. R. P. Borges. VisNote: a tool for interactive visual exploration and text annotation of government gazettes. In *Workshop on Visual Analytics, Information Visualization and Scientific Visualization (WVIS/SIBGRAPI)*, Online, November 7 2020.
- [16] P. H. Luz de Araujo, T. E. de Campos, and M. M. S. de Sousa. Inferring the source official texts: can SVM beat ULMFiT? In *International Conference on the Computational Processing of Portuguese (PROPOR)*, Lecture Notes on Computer Science (LNCS), Evora, Portugal, March 2–4 2020. Springer.
- [17] P. H. Luz de Araujo, T. E. de Campos, F. A. Braz, and N. C. Silva. Victor: a dataset for Brazilian legal documents classification. In *12th Language Resources and Evaluation Conference (LREC)*, pages 1449–1458, Marseille, France, May 2020.
- [18] P. H. Luz de Araujo and T. E. de Campos. Topic modelling Brazilian supreme court lawsuits. In *33rd International Conference on Legal Knowledge ad Information Systems (JURIX)*, Czech Republic (online), December 9–11 2020.
- [19] P. H. Luz de Araujo. From documents to entities: A journey through natural language processing tasks and domains. Technical report, University of Brasilia, Department of Computer Science, July 2020. Supervised by T. E. de Campos. Available from <https://teodecampos.github.io/peLuz>.
- [20] H. C. Jung, N. D. G. Jr., R. S. Ramos, B. Macchiavello, E. Peixoto, E. M. Hung, T. de Campos, R. C. da Silva, V. Testoni, and P. G. Freitas. Multi-mode intra prediction for learning-based image compression. In *International Conference on Image Processing (ICIP)*, pages 1296–1300, Abu Dhabi, October 25 2020. IEEE Signal Processing Society. DOI: 10.1109/ICIP40778.2020.9191108.
- [21] F. Guth. The information bottleneck theory of deep learning. Technical report, University of Brasilia, Department of Computer Science, July 2020. Supervised by T. E. de Campos. Available from https://teodecampos.github.io/fred_guth.
- [22] A. Dourado, H. Kim, T. E. de Campos, and A. Hilton. Semantic scene completion from a single 360-degree image and depth map. In *15th International Conference on Computer Vision Theory and Applications (VISAPP) - part of VISIGRAPP*, Valletta, Malta, February 27–29 2020.
- [23] T. de Carvalho Gallo Pereira and T. E. de Campos. Domain adaptation for person re-identification on new unlabeled data. In *15th International Conference on Computer Vision Theory and Applications (VISAPP) - part of VISIGRAPP*, Valletta, Malta, February 27–29 2020. Best student paper award.
- [24] P. Inazawa, F. Hartmann, T. de Campos, N. Silva, and F. A. Braz. Projeto Victor. *Revista Computacao Brasil*, 39(1):19–24, April 2019. Available at <https://www.sbc.org.br/publicacoes-2/298-computacao-brasil>.
- [25] F. Guth and T. E. de Campos. Research frontiers in transfer learning – a systematic and bibliometric review, 2019, 1912.08812. Available from <https://arxiv.org/abs/1912.08812>.
- [26] A. Dourado, F. Guth, T. E. de Campos, and W. Li. Domain adaptation for holistic skin detection. Technical report, Cornell University Library, March 2019. arXiv:1903.06969.
- [27] A. Dourado, T. E. de Campos, H. Kim, and A. Hilton. EdgeNet: Semantic scene completion from RGB-D images. Technical Report arXiv:1908.02893, Cornell University Library, August 2019. arXiv:1908.02893.
- [28] L. W. X. Cejnog, R. M. C. Jr., T. E. de Campos, and V. M. C. Elui. Hand range of motion evaluation for rheumatoid arthritis patients. In *14th IEEE International Conference on Automatic Face and Gesture Recognition (FG)*, Lille, France, May 14–18 2019. 1903.06949. Preprint available at arXiv:1903.06949.

- [29] D. Alves Bezerra, P. H. G. Inazawa, R. Zumblick, T. E. de Campos, N. C. da Silva, F. A. Braz, and F. H. Peixoto. Descoberta de termos que caracterizam peças jurídicas. In *11th International Conference on Forensic Computer Science and Cyber Law (ICoFCS)*, São Paulo, Brazil, November 4–5 2019. Best paper award.
- [30] P. H. Luz de Araujo, T. E. de Campos, R. R. R. de Oliveira, M. Stauffer, S. Couto, and P. Bermejo. LeNER-Br: a dataset for named entity recognition in Brazilian legal text. In *International Conference on the Computational Processing of Portuguese (PROPOR)*, Lecture Notes on Computer Science (LNCS), pages 313–323, Canela, RS, Brazil, September 24–26 2018. Springer.
- [31] Q. Liu, W. Wang, T. E. de Campos, P. J. Jackson, and A. Hilton. Multiple speaker tracking in spatial audio via PHD filtering and depth-audio fusion. *IEEE Transactions on Multimedia*, 2018. DOI:10.1109/TMM.2017.2777671.
- [32] F. Guth and T. E. de Campos. Skin lesion segmentation using u-net and good training strategies. Technical report, Cornell University Library, 2018, 1811.11314. arXiv:1811.11314.
- [33] F. Guth and T. E. de Campos. Skin lesion segmentation and classification – UnB entry at the ISIC challenge. In *ISIC Challenge on Skin Lesion Analysis Towards Melanoma Detection*. International Skin Imaging Collaboration, 2018. <https://challenge2018.isic-archive.com/>.
- [34] A. B. S. Guedes, T. E. de Campos, and A. Hilton. Semantic scene completion combining colour and depth: preliminary experiments. Technical report, Cornell University Library, February 2018. arXiv:1802.04735.
- [35] E. Dazzi, T. E. de Campos, A. Hilton, and R. M. Cesar-Jr. Scalable object instance recognition based on keygraph matching. *Pattern Recognition Letters*, 114:53–62, 2018. DOI:10.1016/j.patrec.2017.10.038.
- [36] N. C. da Silva, F. A. Braz, T. E. de Campos, D. Gusmao, F. Chaves, D. Mendes, D. Bezerra, G. Ziegler, L. Horinouchi, M. Ferreira, G. Carvalho, R. V. C. Fernandes, F. H. Peixoto, M. S. M. Filho, B. P. Sukiennik, L. S. Rosa, R. Z. M. Silva, and T. A. Junquilho. Document type classification for Brazil’s supreme court using a convolutional neural network. In *10th International Conference on Forensic Computer Science and Cyber Law (ICoFCS)*, Sao Paulo, Brazil, October 29–30 2018. Best paper award.
- [37] P. Coleman, A. Franck, J. Francombe, Q. Liu, T. E. de Campos, R. Hughes, D. Menzies, S. Galvez, Y. Tang, J. Woodcock, P. J. Jackson, F. Melchior, C. Pike, F. M. Fazi, T. J. Cox, and A. Hilton. An audio-visual system for object-based audio: From recording to listening. *IEEE Transactions on Multimedia*, 2018. DOI:10.1109/TMM.2018.2794780.
- [38] L. W. X. Cejnog, R. M. Cesar Jr., T. E. de Campos, and V. M. C. Elui. Injured hand therapy evaluation using hand tracking. In *31st Conference on Graphics, Patterns and Images (SIBGRAPI)*, Foz do Iguaçu, Brazil, October 29 - November 01 2018. SBC. Project page: <http://vision.ime.usp.br/~cejnog/handanalysis/>.
- [39] F. A. Braz, N. C. da Silva, T. E. de Campos, F. B. S. Chaves, M. H. S. Ferreira, P. H. Inazawa, V. H. D. Coelho, B. P. Sukiennik, A. P. G. S. de Almeida, F. B. Vidal, D. A. Bezerra, D. B. Gusmao, G. G. Ziegler, R. V. C. Fernandes, R. Zumblick, and F. H. Peixoto. Document classification using a bi-lstm to unlog Brazil’s supreme court. In *NeurIPS workshop on Machine Learning for the Developing World (ML4D)*, December 8 2018. Event webpage: <https://sites.google.com/view/ml4d-nips-2018/>. Published at arXiv:1811.11569.
- [40] M. Ponti, J. Kittler, M. Riva, T. E. de Campos, and C. Zor. A decision cognizant Kullback–Leibler divergence. *Pattern Recognition*, 61:470–478, 2017. DOI:10.1016/j.patcog.2016.08.018.
- [41] G. R. Jones, B. J. Hammett, and T. de Campos. Method of and apparatus for processing image data for display by a multiple-view display device, Sept. 5 2017. US Patent 9,756,318.
- [42] P. Jackson, F. Fazi, F. Melchior, T. Cox, A. Hilton, C. Pike, J. Francombe, A. Franck, P. Coleman, D. Menzies-Gow, J. Woodcock, Y. Tang, Q. Liu, R. Hughes, M. S. Galvez, T. de Campos, H. Kim, and H. Stenzel. Object-based audio rendering. Technical report, Cornell University Library, 2017. arXiv:1708.07218.
- [43] A. B. S. Guedes, T. E. de Campos, and A. Hilton. Semantic scene completion combining colour and depth: preliminary experiments. In *ICCV workshop on 3D Reconstruction Meets Semantics (3DRMS)*, Venice, Italy, October 2017. Event webpage: <http://trimbot2020.webhosting.rug.nl/events/events-2017/3drms/>. Also published at arXiv:1802.04735.
- [44] A. B. S. Guedes. Redes neurais convolucionais para visão computacional. Technical report, Universidade de Brasília, Gama-DF, Brasil, September 2017. Trabalho de conclusão de curso 2, orientado por Teófilo de Campos.
- [45] A. B. S. Guedes. Reconhecimento de gestos usando redes neurais convolucionadas. Technical report, Universidade de Brasília, Gama-DF, Brasil, February 2017. Trabalho de conclusão de curso 1, orientado por Teófilo de Campos.
- [46] N. FarajiDavar, T. de Campos, and J. Kittler. Adaptive transductive transfer machines: A pipeline for unsupervised domain adaptation. In *Domain Adaptation in Computer Vision Applications*, Advances in

- Computer Vision and Pattern Recognition, pages 115–132. Springer International, 2017. DOI:10.1007/978-3-319-58347-1_6.
- [47] T. E. de Campos. Transductive transfer learning for activity recognition. In *Technical Meeting on Transfer Learning in Computer Vision*, London, UK, January 2017. British Machine Vision Association (BMVA). <https://www.cs.bris.ac.uk/~damen/TLCV>.
- [48] M. Riva, M. A. Ponti, and T. E. de Campos. Aprendizado incremental e classe-incremental por meio da atualizacao de arvores geradoras em florestas de caminhos otimos. In *SIBGRAPI Workshop of Undergraduate Works*, São José dos Campos-SP, 2016.
- [49] M. Riva, M. Ponti, and T. de Campos. One-class to multi-class model update using the class-incremental optimum-path forest classifier. In *22nd European Conference on Artificial Intelligence (ECAI)*, volume 285, The Hague, The Netherlands, 29 August-2 September 2016. IOS Press.
- [50] Q. Liu, T. E. de Campos, W. Wang, and A. Hilton. Identity association using PHD filters in multiple head tracking with depth sensors. In *International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, pages 1506–1510. IEEE, 2016. DOI:10.1109/ICASSP.2016.7471928.
- [51] H. Kim, T. de Campos, and A. Hilton. Room layout estimation with object and material attributes information using a spherical camera. In *International Conference on 3D Vision (3DV)*, pages 519–527, Stanford University, California, October 2016. DOI:10.1109/3DV.2016.83.
- [52] P. Jackson, F. Fazi, F. Melchior, T. Cox, A. Hilton, C. Pike, J. Francombe, A. Franck, P. Coleman, D. Menzies-Gow, J. Woodcock, Y. Tang, Q. Liu, R. Hughes, M. S. Galvez, T. de Campos, H. Kim, and H. Stenzel. Object-based audio rendering, may # " 23" 2016. GB Patent Application GB1609316.3.
- [53] E. Dazzi, T. de Campos, A. Hilton, and R. M. Cesar Jr. Efficient object recognition using sampling of key-point triples and keygraph structure. In *29th Conference on Graphics, Patterns and Images, SIBGRAPI*, pages 112–119, São Paulo, Brazil, October 4–7 2016. DOI:10.1109/SIBGRAPI.2016.024.
- [54] D. Windridge, J. Kittler, T. E. de Campos, F. Yan, W. Christmas, and A. Khan. A novel Markov logic rule induction strategy for characterizing sports video footage. *IEEE MultiMedia*, 22(2):24–35, 2015. DOI:10.1109/MMUL.2014.36.
- [55] M. Veta, P. J. van Diest, S. M. Willems, H. Wang, A. Madabhusli, A. Cruz-Roa, F. Gonzalez, A. B. Larsen, J. S. Vestergaard, A. B. Dahl, D. C. Ciresan, J. Schmidhuber, A. Ciusti, L. M. Gambardella, F. B. Tek, T. Walter, C.-W. Wang, S. Kondo, B. J. Matuszewski, F. Precioso, V. Snell, J. Kittler, T. E. de Campos, A. M. Khan, N. M. Rajpoot, E. Arkoumani, M. M. Lacle, M. A. Viergever, and J. P. Pluim. Assessment of algorithms for mitosis detection in breast cancer histopathology images. *Medical Image Analysis*, 20(1):237 – 248, 2015. DOI:10.1016/j.media.2014.11.010.
- [56] M. F. Simon Galvez, F. M. Fazi, D. Menzies, T. de Campos, and A. Hilton. Listener tracking stereo for object based audio reproduction. In *46º Congresso Español de Acústica, Encuentro Ibérico de Acústica, European Symposium on Virtual Acoustics and Ambisonics*, Valencia, Spain, 2015.
- [57] Q. Liu, T. de Campos, W. Wang, P. Jackson, and A. Hilton. Person tracking using audio and depth cues. In IEEE, editor, *Proceedings of the ICCV Workshop on 3D Reconstruction and Understanding with Video and Sound*, Santiago, Chile, December 2015.
- [58] M. F. S. Galvez, D. Menzies, F. M. Fazi, T. E. de Campos, and A. Hilton. A listener position adaptive stereo system for object-based reproduction. In *Audio Engineering Society Convention 138*, 2015.
- [59] N. FarajiDavar. *Transfer Learning for Computer Vision*. PhD thesis, University of Surrey, Guildford, UK, 2015. Supervised by Teófilo de Campos, available from <https://teodecampos.github.io/TransferLearning/>.
- [60] J. Kittler, W. Christmas, T. E. de Campos, D. Windridge, F. Yan, J. Illingworth, and M. Osman. Domain anomaly detection in machine perception: A system architecture and taxonomy. *IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI)*, 36(5):845–859, May 2014. DOI:10.1109/TPAMI.2013.209.
- [61] N. FarajiDavar, T. de Campos, and J. Kittler. Transductive transfer machine. In *Proceedings of the Asian Conference on Computer Vision (ACCV)*, Singapore, November 2014.
- [62] N. FarajiDavar, T. de Campos, and J. Kittler. Adaptive transductive transfer machine. In *Proceedings of the British Machine Vision Conference (BMVC)*, Nottingham, September 2014.
- [63] T. E. de Campos. A survey on computer vision tools for action recognition, crowd surveillance and suspect retrieval. In *Seminário Integrado de Software e Hardware (SEMISH) – XXXIV Congresso da Sociedade Brasileira de Computacao (CSBC)*, pages 1123–1132, Brasília, July 2014.
- [64] T. E. De Campos and F. C. Perronnin. Modeling images as sets of weighted features, July 8 2014. US Patent 8,774,498.
- [65] E. Dazzi, T. de Campos, and R. M. Cesar Jr. Improved object matching using structural relations. In *IAPR Joint International Workshops on Statistical Techniques in Pattern Recognition and Structural and*

- Synthactic Pattern Recognition (S+SSPR)*, Lecture Notes in Computer Science (LNCS), pages 444–453, 2014.
- [66] D. Coppi, T. E. de Campos, F. Yan, J. Kittler, and R. Cucchiara. On detection of novel categories and subcategories of images using incongruence. In *ACM International Conference on Multimedia Retrieval (ICMR)*, 2014.
 - [67] J. McAuley and T. E. De Campos. Unified graph matching in euclidean spaces and applications to image comparison and retrieval, Mar. 26 2013. US Patent 8,407,029.
 - [68] T. E. de Campos, A. Khan, F. Yan, N. FarajiDavar, D. Windridge, J. Kittler, and W. Christmas. A framework for automatic sports video annotation with anomaly detection and transfer learning. In *Machine Learning and Cognitive Science, collocated with EUCOGIII*, 2013.
 - [69] J. Sanchez, F. Perronnin, and T. E. de Campos. Modeling the spatial layout of images beyond spatial pyramids. *Pattern Recognition Letters (PRL)*, 2012. DOI:10.1016/j.patrec.2012.07.019.
 - [70] N. FarajiDavar, T. de Campos D. Windridge, J. Kittler, and W. Christmas. Domain adaptation in the context of sport video action recognition. In *4th UK Computer Vision Student Workshop (BMVW), in conjunction with the British Machine Vision Conference (BMVC)*, Guildford, UK, 2012.
 - [71] T. E. de Campos, G. Csurka, and F. Perronnin. Images as sets of locally weighted features. *Computer Vision and Image Understanding (CVIU)*, 2012. DOI:10.1016/j.cviu.2011.07.011.
 - [72] I. Calixto, T. de Campos, and L. Specia. Images as context in statistical machine translation. In *The 2nd Annual Meeting of the EPSRC Network on Vision & Language (VL12)*, Sheffield, December 2012. EPSRC Vision and Language Network.
 - [73] I. Almajai, F. Yan, T. de Campos, A. Khan, W. Christmas, D. Windridge, and J. Kittler. Anomaly detection and knowledge transfer in automatic sports video annotation. In *Studies in Computational Intelligence, DIRAC*. Springer, 2012. editors: D Weinshall and J Anemuller and L van Gool.
 - [74] Q. Huang, S. Cox, F. Yan, T. E. de Campos, D. Windridge, J. Kittler, and W. Christmas. Improved detection of ball hit events in a tennis game using multimodal information. In *11th International Conference on Auditory-Visual Speech Processing (AVSP)*, Volterra, Italy, September 2011.
 - [75] N. FarajiDavar, T. E. de Campos, D. Windridge, J. Kittler, and W. Christmas. Domain adaptation in the context of sport video action recognition. In *Domain Adaptation Workshop, in conjunction with NIPS*, 2011.
 - [76] N. FarajiDavar, T. E. de Campos, J. Kittler, and F. Yan. Transductive transfer learning for action recognition in tennis games. In *3rd International Workshop on Video Event Categorization, Tagging and Retrieval for Real-World Applications (VECTaR), in conjunction with ICCV*, 2011.
 - [77] T. de Campos, M. Barnard, K. Mikolajczyk, J. Kittler, F. Yan, W. Christmas, and D. Windridge. An evaluation of bags-of-words and spatio-temporal shapes for action recognition. In *IEEE Workshop on Applications of Computer Vision (WACV)*, Kona, Hawaii, January 2011.
 - [78] J. J. McAuley, T. E. de Campos, and T. S. Caetano. Unified graph matching in euclidean spaces. In *Conference on Computer Vision and Pattern Recognition (CVPR)*, San Francisco, 2010. IEEE.
 - [79] A. Khan, D. Windridge, T. de Campos, J. Kittler, and W. Christmas. Lattice-based anomaly rectification for sport video annotation. In *Proceedings of the International Conference on Pattern Recognition (ICPR)*, 2010.
 - [80] T. E. de Campos, G. Csurka, and F. Perronnin. Images as sets of locally weighted features. Technical Report VSSP-TR-1/2010, FEPS, University of Surrey, Guildford, UK, August 2010.
 - [81] I. Almajai, J. Kittler, T. de Campos, W. Christmas, F. Yan, D. Windridge, and A. Khan. Ball event recognition using HMM for automatic tennis annotation. In *Proceedings of Intl. Conf. on Image Processing (ICIP)*, 2010.
 - [82] Almajai, F. Yan, T. de Campos, A. Khan, W. Christmas, D. Windridge, and J. Kittler. Anomaly detection and knowledge transfer in automatic sports video annotation. In *Proceedings of DIRAC Workshop, European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML PKDD 2010)*, 2010.
 - [83] J. J. McAuley, T. de Campos, G. Csurka, and F. Perronnin. Hierarchical image-region labeling via structured learning. In *Proc British Machine Vision Conf (BMVC)*, London, September 2009.
 - [84] J. McAuley, T. E. De Campos, G. Csurka, and F. Perronnin. Consistent hierarchical labeling of image and image regions, Aug. 25 2009. US Patent App. 12/546,948.
 - [85] T. E. de Campos, B. R. Babu, and M. Varma. Character recognition in natural images. In *International Conference on Computer Vision Theory and Applications (VISAPP) - part of VISIGRAPP*, Lisbon, Portugal, February 2009. Presents the Chars74K dataset.

- [86] A. Klami, C. Saunders, T. E. de Campos, and S. Kaski. Can relevance of images be inferred from eye movements? In *Proceeding of the International Conference on Multimedia Information Retrieval*, Vancouver, Canada, October 2008. ACM.
- [87] G. R. Jones, B. J. Hammett, and T. E. de Campos. Method of and apparatus for processing image data for display by a multiple-view display device, 2008. US Patent App. 12/523,450.
- [88] T. E. de Campos, B. J. Tordoff, and D. W. Murray. Recovering articulated pose: A comparison of two pre and postimposed constraint methods. *Transactions on Pattern Analysis and Machine Intelligence*, 28(1), 2006.
- [89] T. E. de Campos and D. W. Murray. Regression-based hand pose estimation from multiple cameras. In *Proceedings of the Conference on Computer Vision and Pattern Recognition (CVPR)*, New York, June 2006. IEEE.
- [90] T. E. de Campos, W. W. Mayol-Cuevas, and D. W. Murray. Directing the attention of a wearable camera by pointing gestures. In *Brazilian Symposium on Computer Graphics and Image Processing (SIBGRAPI)*, Manaus, Brazil, October 2006. IEEE.
- [91] T. E. de Campos. *3D Visual Tracking of Articulated Objects and Hands*. PhD thesis, University of Oxford, 2006.
- [92] W. W. Mayol, B. J. Tordoff, T. E. de Campos, A. J. Davison, and D. W. Murray. Active vision forwearables. In *Eurowearable*, 2003.
- [93] B. Tordoff, W. W. Mayol, T. E. de Campos, and D. Murray. Head pose estimation for wearable robot control. In *British Machine Vision Conference (BMVC)*, Cardiff, Wales, 2002.
- [94] T. E. de Campos and R. M. Cesar-Jr. Advances on feature selection techniques with applications to face recognition. In *Anais do Concurso de teses e dissertações da Sociedade Brasileira de Computação (CTD-SBC)*, Florianopolis-SC, Brazil, July 2002. Preprint available at http://www.robots.ox.ac.uk/~teo/ctd_sbc/.
- [95] T. E. de Campos, I. Bloch, and R. M. Cesar-Jr. Feature selection based on fuzzy distances between clusters: First results on simulated data. In *International Conference on Advances in Pattern Recognition (ICAPR)*, Rio de Janeiro, Brazil, 2001.
- [96] R. S. Feris, T. E. de Campos, and R. M. Cesar-Jr. Detection and tracking of facial features in video sequences. In *MICAI*, Acapulco, Mexico, 2000.
- [97] T. E. de Campos, F. S. Feris, and R. M. Cesar-Jr. Improved face x non-face discrimination using fourier descriptors through feature selection. In *SIBGRAPI*, Gramado, Brazil, 2000.
- [98] T. E. de Campos, F. S. Feris, and R. M. Cesar-Jr. A framework for face recognition from video sequences using gwn and eigenfeature selection. In *WAICV*, Atibaia, Brazil, 2000.
- [99] T. E. de Campos, F. S. Feris, and R. M. Cesar-Jr. Eigenfaces versus eigeneyes: First steps toward performance assessment of representarions for face recognition. In *MICAI*, Acapulco, Mexico, 2000.
- [100] T. E. de Campos. Sistema de segurança informatizado - hardware. In *51ª Reunião da Sociedade Brasileira para o Progresso da Ciência SBPC*, Porto Alegre - RS, julho 1999.
- [101] T. E. de Campos. Projeto de hardware para sistema de segurança informatizado. In *XXV Colóquio de Incentivo à Pesquisa - IBILCE/UNESP*, São José do Rio Preto - SP, agosto 1998.
- [102] T. E. de Campos. Projeto de hardware para o sistema de segurança informatizado. In *X Congresso de Iniciação Científica - UNESP*, Rio Claro - SP, outubro 1998.