Deep learning solutions for domain-specific image segmentation

Vadineanu, S.

Bibliography

[1] Natalia Abellán, Blanca Jiménez-García, José Aznarte, Enrique Baquedano, and Manuel Domínguez-Rodrigo. Deep learning classification of tooth scores made by different carnivores: Achieving high accuracy when comparing African carnivore taxa and testing the hominin shift in the balance of power. Archaeological and Anthropological Sciences, 13(2):1–14, 2021.

[2] Abien Fred Agarap. Deep learning using rectified linear units (ReLU), 2019. arXiv:1803.08375.

[3] Hina Ajmal, Saad Rehman, Umar Farooq, Qurrat U. Ain, Farhan Riaz, and Ali Hassan. Convolutional neural network based image segmentation: A review. Pattern Recognition and Tracking, 10649:191–203, 2018.

[4] Saad Ullah Akram, Juho Kannala, Lauri Eklund, and Janne Heikkilä. Cell segmentation proposal network for microscopy image analysis. In Deep Learning and Data Labeling for Medical Applications, volume 10008 of Lecture Notes in Computer Science, pages 21–29. Springer, 2016.

[5] Yousef Al-Kofahi, Wiem Lassoued, William Lee, and Badrinath Roysam. Improved automatic detection and segmentation of cell nuclei in histopathology images. IEEE Transactions on Biomedical Engineering, 57(4):841–852, 2009.

[6] Conrad M. Albrecht, Chris Fisher, Marcus Freitag, Hendrik F. Hamann, Sharathchandra Pankanti, Florencia Pezzutti, and Francesca Rossi. Learning and recognizing archeological features from LiDAR data. In IEEE International Conference on Big Data, pages 5630–5636. IEEE, 2019.

[7] Dimitris Alexakis, Theodoros Astaras, Apostolos Sarris, Kostas Vouzaxakis, and Lia Karimali. Reconstructing the neolithic landscape of Thessaly through a GIS and geological approach. In International Conference on Computer Applications and Quantitative Methods in Archaeology, volume 10, pages 405–410. Bonn: Dr. Rudolf Habelt GmbH, 2008.

[8] Laith Alzubaidi, Jinglan Zhang, Amjad J. Humaidi, Ayad Al-Dujaili, Ye Duan, Omran Al-Shamma, J. Santamaría, Mohammed A. Fadhel, Muthana Al-Amidie, and Laith Farhan. Review of deep learning: Concepts, CNN architectures, challenges, applications, future directions. Journal of Big Data, 8(1):53, 2021.

[9] Maruthamuthu Angulakshmi and Gnanapandithan G. Lakshmi Priya. Automated brain tumour segmentation techniques— A review. International Journal of Imaging Systems and Technology, 27(1):66–77, 2017.

[10] Ricardo J. Araújo, Jaime S. Cardoso, and Hélder P. Oliveira. A deep learning design for improving topology coherence in blood vessel segmentation. In Medical Image Computing and Computer Assisted Intervention, volume 11764 of Lecture Notes in Computer Science, pages 93–101. Springer, 2019.

[11] Vijay Badrinarayanan, Alex Kendall, and Roberto Cipolla. Segnet: A deep convolutional encoder-decoder architecture for image segmentation. IEEE Transactions on Pattern Analysis and Machine Intelligence, 39(12):2481–2495, 2017.

[12] Roberto Battiti. First-and second-order methods for learning: Between steepest descent and Newton's method. Neural Computation, 4(2):141–166, 1992.

[13] Mehdi Benchoufi, Eric Matzner-Lober, Nicolas Molinari, Anne-Sophie Jannot, and Philippe Soyer. Interobserver agreement issues in radiology. Diagnostic and Interventional Imaging, 101(10):639–641, 2020.

[14] Robert Bensch and Olaf Ronneberger. Cell segmentation and tracking in phase contrast images using graph cut with asymmetric boundary costs. In IEEE International Symposium on Biomedical Imaging, pages 1220–1223. IEEE, 2015.

[15] Iban Berganzo-Besga, Hector A. Orengo, Felipe Lumbreras, Miguel Carrero-Pazos, João Fonte, and Benito Vilas-Estévez. Hybrid MSRM-based deep learning and multitemporal sentinel 2-based machine learning algorithm detects near 10k archaeological tumuli in North-Western Iberia. Remote Sensing, 13(20):4181, 2021.

[16] Chandradeep Bhatt, Indrajeet Kumar, V. Vijayakumar, Kamred Udham Singh, and Abhishek Kumar. The state of the art of deep learning models in medical science and their challenges. Multimedia Systems, 27(4):599–613, 2021.

[17] Patrick Bilic, Patrick Christ, Hongwei Bran Li, Eugene Vorontsov, Avi Ben-Cohen, Georgios Kaissis, Adi Szeskin, Colin Jacobs, Gabriel Efrain Humpire Mamani, and Gabriel Chartrand. The liver tumor segmentation benchmark (LiTS). Medical Image Analysis, 84:102680, 2023.

[18] Alexander Bonhage, Mahmoud Eltaher, Thomas Raab, Michael Breuß, Alexandra Raab, and Anna Schneider. A modified Mask region-based convolutional neural network approach for the automated detection of archaeological sites on high-resolution light detection and ranging-derived digital elevation models in the North German Lowland. Archaeological Prospection, 28(2):177–186, 2021.

[19] Carolyn Burnett and Thomas Blaschke. A multi-scale segmentation/object relationship modelling methodology for landscape analysis. Ecological Modelling, 168(3):233–249, 2003.

[20] Stefano Campana and Salvatore Piro. Seeing the unseen. Geophysics and landscape archaeology. CRC Press, 2008.

[21] Yigit B. Can, Krishna Chaitanya, Basil Mustafa, Lisa M. Koch, Ender Konukoglu, and Christian F. Baumgartner. Learning to segment medical images with scribble-supervision alone. In Deep Learning in Medical Image Analysis and Multimodal Learning for Clinical Decision Support, volume 11045 of Lecture Notes in Computer Science, pages 236–244. Springer, 2018.

[22] Aaron Carass, Snehashis Roy, Amod Jog, Jennifer L. Cuzzocreo, Elizabeth Magrath, Adrian Gherman, Julia Button, James Nguyen, Ferran Prados, and Carole H. Sudre. Longitudinal multiple sclerosis lesion segmentation: Resource and challenge. NeuroImage, 148:77–102, 2017.

[23] Jesse Casana. Remote sensing-based approaches to site morphology and historical geography in the northern fertile crescent. New Agendas in Remote Sensing and Landscape Archaeology in the Near East. Studies in honour of Tony J. Wilkinson: Archaeopress, pages 154–174, 2020.

[24] Jesse Casana, Jackson Cothren, and Tuna Kalayci. Swords into ploughshares: Archaeological applications of CORONA satellite imagery in the Near East. Internet Archaeology, 32(2), 2012.

[25] Gino Caspari and Pablo Crespo. Convolutional neural networks for archaeological site detection–Finding "princely" tombs. Journal of Archaeological Science, 110:104998, 2019.

[26] University of Arkansas/U.S. Geological Survey Center for Advanced Spatial Technologies. Corona @ CAST UA.

[27] Sixian Chan, Cheng Huang, Cong Bai, Weilong Ding, and Shengyong Chen. Res2-UNeXt: A novel deep learning framework for few-shot cell image segmentation. Multimedia Tools and Applications, 81(10):13275–13288, 2022.

[28] Liang-Chieh Chen, George Papandreou, Iasonas Kokkinos, Kevin Murphy, and Alan L. Yuille. Deeplab: Semantic image segmentation with deep convolutional nets, atrous convolution, and fully connected CRFs. IEEE Transactions on Pattern Analysis and Machine Intelligence, 40(4):834–848, 2017.

[29] Shuai Chen, Antonio Garcia-Uceda, Jiahang Su, Gijs van Tulder, Lennard Wolff, Theo van Walsum, and Marleen de Bruijne. Label refinement network from synthetic error augmentation for medical image segmentation. Medical Image Analysis, 99:103355, 2025.

[30] Guy Barrett Coleman and Harry C. Andrews. Image segmentation by clustering. Proceedings of the IEEE, 67(5):773–785, 1979.

[31] Frederick A. Cooper, Marvin E. Bauer, and Brenda C. Cullen. Satellite spectral data and archaeological reconnaissance in western Greece. NASA. Stennis Space Center, Applications of Space-Age Technology in Anthropology, 1991.

[32] Antonia Creswell, Tom White, Vincent Dumoulin, Kai Arulkumaran, Biswa Sengupta, and Anil A. Bharath. Generative adversarial networks: An overview. IEEE Signal Processing Magazine, 35(1):53–65, 2018.

[33] Jay F. Custer, Timothy Eveleigh, Vytautas Klemas, and Ian Wells. Application of LANDSAT data and synoptic remote sensing to predictive models for prehistoric archaeological sites: An example from the Delaware coastal plain. American Antiquity, 51(3):572–588, 1986.

[34] Wei Dai, Nanqing Dong, Zeya Wang, Xiaodan Liang, Hao Zhang, and Eric P. Xing. SCAN: Structure correcting adversarial network for organ segmentation in chest X-rays. In Deep Learning in Medical Image Analysis and Multimodal Learning for Clinical Decision Support, volume 11045 of Lecture Notes in Computer Science, pages 263–273. Springer, 2018.

[35] Yousef-Awwad Daraghmi, Tsung-Hsiang Wu, and Tsì-Uí İk. Crowdsourcing-based road surface evaluation and indexing. IEEE Transactions on Intelligent Transportation Systems, 23(5):4164–4175, 2020.

[36] Anurag Das, Yongqin Xian, Yang He, Zeynep Akata, and Bernt Schiele. Urban scene semantic segmentation with low-cost coarse annotation. In IEEE/CVF Winter Conference on Applications of Computer Vision, pages 5978–5987, 2023.

[37] Dylan S. Davis. Object-based image analysis: A review of developments and future directions of automated feature detection in landscape archaeology. Archaeological Prospection, 26(2):155–163, 2019.

[38] Dylan S. Davis, Gino Caspari, Carl P. Lipo, and Matthew C. Sanger. Deep learning reveals extent of Archaic Native American shell-ring building practices. Journal of Archaeological Science, 132:105433, 2021.

[39] Youssef Dawoud, Katharina Ernst, Gustavo Carneiro, and Vasileios Belagiannis. Edge-based self-supervision for semi-supervised few-shot microscopy image cell segmentation. In Medical Optical Imaging and Virtual Microscopy Image Analysis, volume 13578 of Lecture Notes in Computer Science, pages 22–31. Springer, 2022.

[40] Véronique De Laet, Etienne Paulissen, and Marc Waelkens. Methods for the extraction of archaeological features from very high-resolution Ikonos-2 remote sensing imagery, Hisar (southwest Turkey). Journal of Archaeological Science, 34(5):830–841, 2007.

[41] Katleen Deckers and Simone Riehl. Fluvial environmental contexts for archaeological sites in the Upper Khabur basin (Northeastern Syria). Quaternary Research, 67(3):337–348, 2007.

[42] Katleen Deckers and Simone Riehl. Resource exploitation of the Upper Khabur Basin (NE Syria) during the 3rd millennium BC. Paléorient, 34(2):173–189, 2008.

[43] Jean-Paul Demoule and Catherine Perlès. The Greek Neolithic: A new review. Journal of World Prehistory, 7(4):355–416, 1993.

[44] Jia Deng, Wei Dong, Richard Socher, Li-Jia Li, Kai Li, and Li Fei-Fei. ImageNet: A large-scale hierarchical image database. In IEEE Conference on Computer Vision and Pattern Recognition, pages 248–255, 2009.

[45] Lee R. Dice. Measures of the amount of ecologic association between species. Ecology, 26(3):297–302, 1945.

[46] Kurt Diem, Amalia Magaret, Alexis Klock, Lei Jin, Jia Zhu, and Lawrence Corey. Image analysis for accurately counting CD4+ and CD8+ T cells in human tissue. Journal of Virological Methods, 222:117–121, 2015.

[47] Zhipeng Ding, Xu Han, and Marc Niethammer. VoteNet: A deep learning label fusion method for multi-atlas segmentation. In Medical Image Computing and Computer Assisted Intervention, volume 11766, pages 202–210. Springer, 2019.

[48] Manuel Domínguez-Rodrigo, Gabriel Cifuentes-Alcobendas, Blanca Jiménez-García, Natalia Abellán, Marcos Pizarro-Monzo, Elia Organista, and Enrique Baquedano. Artificial intelligence provides greater accuracy in the classification of modern and ancient bone surface modifications. Nature Scientific Reports, 10(1):18862, 2020.

[49] Venkata Gopal Edupuganti, Akshay Chawla, and Amit Kale. Automatic optic disk and cup segmentation of fundus images using deep learning. In IEEE International Conference on Image Processing, pages 2227–2231, 2018.

[50] Andreas Ess, Tobias Mueller, Helmut Grabner, and Luc Van Gool. Segmentation-based urban traffic scene understanding. In Procedings of the British Machine Vision Conference 2009, pages 84.1–84.11. British Machine Vision Association, 2009.

[51] Andre Esteva, Brett Kuprel, Roberto A. Novoa, Justin Ko, Susan M. Swetter, Helen M. Blau, and Sebastian Thrun. Dermatologist-level classification of skin cancer with deep neural networks. Nature, 542(7639):115–118, 2017.

[52] Thorsten Falk, Dominic Mai, Robert Bensch, Özgün Çiçek, Ahmed Abdulkadir, Yassine Marrakchi, Anton Böhm, Jan Deubner, Zoe Jäckel, Katharina Seiwald, Alexander Dovzhenko, Olaf Tietz, Cristina Dal Bosco, Sean Walsh, Deniz Saltukoglu, Tuan Leng Tay, Marco Prinz, Klaus Palme, Matias Simons, Ilka Diester, Thomas Brox, and Olaf Ronneberger. U-Net: Deep learning for cell counting, detection, and morphometry. Nature Methods, 16(1):67–70, 2019.

[53] Rong-En Fan, Kai-Wei Chang, Cho-Jui Hsieh, Xiang-Rui Wang, and Chih-Jen Lin. LIBLINEAR: A library for large linear classification. Journal of Machine Learning Research, 9(61):1871–1874, 2008.

[54] Pedro F. Felzenszwalb and Daniel P. Huttenlocher. Efficient graph-based image segmentation. International Journal of Computer Vision, 59(2):167–181, 2004.

[55] Ruiwei Feng, Xiangshang Zheng, Tianxiang Gao, Jintai Chen, Wenzhe Wang, Danny Z. Chen, and Jian Wu. Interactive few-shot learning: Limited supervision, better medical image segmentation. IEEE Transactions on Medical Imaging, 40(10):2575–2588, 2021.

[56] Abdur R. Feyjie, Reza Azad, Marco Pedersoli, Claude Kauffman, Ismail Ben Ayed, and Jose Dolz. Semi-supervised few-shot learning for medical image segmentation, 2020. arXiv:2003.08462.

[57] Ruth C. Fong and Andrea Vedaldi. Interpretable Explanations of Black Boxes by Meaningful Perturbation. In IEEE International Conference on Computer Vision), pages 3449–3457. IEEE, 2017.

[58] Martin J. Fowler. The archaeological potential of declassified HEXAGON KH-9 panoramic camera satellite photographs. AARG News, 53(210):30–36, 2016.

[59] Simon Graham, Mostafa Jahanifar, Ayesha Azam, Mohammed Nimir, Yee-Wah Tsang, Katherine Dodd, Emily Hero, Harvir Sahota, Atisha Tank, Ksenija Benes, et al. Lizard: A large-scale dataset for colonic nuclear instance segmentation and classification. In IEEE/CVF International Conference on Computer Vision, pages 684–693, 2021.

[60] Simon Graham, Quoc Dang Vu, Shan E Ahmed Raza, Ayesha Azam, Yee Wah Tsang, Jin Tae Kwak, and Nasir Rajpoot. Hover-Net: Simultaneous segmentation and classification of nuclei in multi-tissue histology images. Medical Image Analysis, 58:101563, 2019.

[61] Noah F. Greenwald, Geneva Miller, Erick Moen, Alex Kong, Adam Kagel, Thomas Dougherty, Christine Camacho Fullaway, Brianna J. McIntosh, Ke Xuan Leow, Morgan Sarah Schwartz, Cole Pavelchek, Sunny Cui, Isabella Camplisson, Omer Bar-Tal, Jaiveer Singh, Mara Fong, Gautam Chaudhry, Zion Abraham, Jackson Moseley, Shiri Warshawsky, Erin Soon, Shirley Greenbaum, Tyler Risom, Travis Hollmann, Sean C. Bendall, Leeat Keren, William Graf, Michael Angelo, and David Van Valen. Whole-cell segmentation of tissue images with human-level performance using large-scale data annotation and deep learning. Nature Biotechnology, 40(4):555–565, 2022.

[62] Yanming Guo, Yu Liu, Theodoros Georgiou, and Michael S. Lew. A review of semantic segmentation using deep neural networks. International Journal of Multimedia Information Retrieval, 7(2):87–93, 2018.

[63] Alexandre Guyot, Marc Lennon, Thierry Lorho, and Laurence Hubert-Moy. Combined detection and segmentation of archeological structures from LiDAR data using a deep learning approach. Journal of Computer Applications in Archaeology, 4(1):x, 2021.

[64] Emily Hammer, Mackinley FitzPatrick, and Jason A. Ur. Succeeding CORONA: Declassified HEXAGON intelligence imagery for archaeological and historical research. Antiquity, 96(387):679–695, 2022.

[65] Emily Hammer and Jason A. Ur. Near Eastern landscapes and declassified U2 aerial imagery. Advances in Archaeological Practice, 7(2):107–126, 2019.

[66] Kaiming He, Xiangyu Zhang, Shaoqing Ren, and Jian Sun. Deep residual learning for image recognition. In IEEE Conference on Computer Vision and Pattern Recognition, pages 770–778, 2016.

[67] Nicholas Heller, Joshua Dean, and Nikolaos Papanikolopoulos. Imperfect segmentation labels: How much do they matter? In Intravascular Imaging and Computer Assisted Stenting and Large-Scale Annotation of Biomedical Data and Expert Label Synthesis, pages 112–120. Springer, 2018.

[68] Théophraste Henry, Alexandre Carré, Marvin Lerousseau, Théo Estienne, Charlotte Robert, Nikos Paragios, and Eric Deutsch. Brain tumor segmentation with self-ensembled, deeply-supervised 3D U-Net neural networks: A BraTS 2020 challenge solution. In Brainlesion: Glioma, Multiple Sclerosis, Stroke and Traumatic Brain Injuries, pages 327–339. Springer, 2021.

[69] Geoffrey Hinton, Oriol Vinyals, and Jeff Dean. Distilling the knowledge in a neural network, 2015. arXiv:1503.02531 [stat].

[70] Matthias Holschneider, Richard Kronland-Martinet, Jean Morlet, and Ph Tchamitchian. A real-time algorithm for signal analysis with the help of the wavelet transform. In Wavelets, pages 286–297. Springer, 1990.

[71] Gao Huang, Zhuang Liu, Laurens Van Der Maaten, and Kilian Q. Weinberger. Densely connected convolutional networks. In IEEE Conference on Computer Vision and Pattern Recognition, pages 2261–2269. IEEE, 2017.

[72] Elise Jakoby. Considering Kranzhügeln: An exploration into the structural variation and environmental/spatial distribution of the third millennium "Kranzhügel" sites. PhD thesis, University of Arkansas, Fayetteville, 2013.

[73] Peng-Tao Jiang, Chang-Bin Zhang, Qibin Hou, Ming-Ming Cheng, and Yunchao Wei. LayerCAM: Exploring hierarchical class activation maps for localization. IEEE Transactions on Image Processing, 30:5875–5888, 2021.

[74] Licheng Jiao and Jin Zhao. A survey on the new generation of deep learning in image processing. IEEE Access, 7:172231–172263, 2019.

[75] Brian Alan Johnson and Lei Ma. Image segmentation and object-based image analysis for environmental monitoring: Recent areas of interest, researchers' views on the future priorities. Remote Sensing, 12(11):1772, 2020.

[76] Singaraju Jyothi. A survey on threshold based segmentation technique in image processing. International Journal of Innovative Research and Development, 3(12):234–239, 2014.

[77] Uday Kamath, John Liu, and James Whitaker. Deep learning for NLP and speech recognition. Springer, 2019.

[78] Nitin Kanagaraj, David Hicks, Ayush Goyal, Sanju Tiwari, and Ghanapriya Singh. Deep learning using computer vision in self driving cars for lane and traffic sign detection. International Journal of System Assurance Engineering and Management, 12(6):1011–1025, 2021.

[79] Sota Kato and Kazuhiro Hotta. One-shot and partially-supervised cell image segmentation using small visual prompt. In IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops, pages 4295–4304, 2023.

[80] A. Emre Kavur, N. Sinem Gezer, Mustafa Barış, Sinem Aslan, Pierre-Henri Conze, Vladimir Groza, Duc Duy Pham, Soumick Chatterjee, Philipp Ernst, Savaş Özkan, Bora Baydar, Dmitry Lachinov, Shuo Han, Josef Pauli, Fabian Isensee, Matthias Perkonigg, Rachana Sathish, Ronnie Rajan, Debdoot Sheet, Gurbandurdy Dovletov, Oliver Speck, Andreas Nürnberger, Klaus H. Maier-Hein, Gözde Bozdağı Akar, Gözde Ünal, Oğuz Dicle, and M. Alper Selver. CHAOS challenge - combined (CT-MR) healthy abdominal organ segmentation. Medical Image Analysis, 69:101950, 2021.

[81] Matthew R. Keaton, Ram J. Zaveri, and Gianfranco Doretto. CellTranspose: Few-shot domain adaptation for cellular instance segmentation. In IEEE/CVF Winter Conference on Applications of Computer Vision, pages 455–466, 2023.

[82] Diederik P. Kingma and Jimmy Ba. Adam: A method for stochastic optimization. In International Conference on Learning Representations. Ithaca, 2014.

[83] Alexander Kirillov, Eric Mintun, Nikhila Ravi, Hanzi Mao, Chloe Rolland, Laura Gustafson, Tete Xiao, Spencer Whitehead, Alexander C. Berg, Wan-Yen Lo, Piotr Dollár, and Ross Girshick. Segment anything. In IEEE/CVF International Conference on Computer Vision, pages 3992–4003, 2023.

[84] Andrew B. Knott, Guy Perkins, Robert Schwarzenbacher, and Ella Bossy-Wetzel. Mitochondrial fragmentation in neurodegeneration. Nature Reviews Neuroscience, 9(7):505–518, 2008.

[85] Narine Kokhlikyan, Vivek Miglani, Miguel Martin, Edward Wang, Bilal Alsallakh, Jonathan Reynolds, Alexander Melnikov, Natalia Kliushkina, Carlos Araya, Siqi Yan, and Orion Reblitz-Richardson. Captum: A unified and generic model interpretability library for PyTorch, 2020. arXiv:2009.07896 [cs].

[86] Daniel Krentzel, Spencer L. Shorte, and Christophe Zimmer. Deep learning in image-based phenotypic drug discovery. Trends in Cell Biology, 33(7):538–554, 2023.

[87] Melda Küçükdemirci and Apostolos Sarris. Deep learning based automated analysis of archaeo-geophysical images. Archaeological Prospection, 27(2):107–118, 2020.

[88] Karsten Lambers, Wouter Verschoof-van Der Vaart, and Quentin Bourgeois. Integrating remote sensing, machine learning, and citizen science in Dutch archaeological prospection. Remote Sensing, 11(7):794, 2019.

[89] Bennett Landman, Zhoubing Xu, J. Iglesias, Martin Styner, T. Langerak, and Arno Klein. Multi-atlas labeling beyond the cranial vault – workshop and challenge. In Proceedings of MICCAI Workshop Challenge, volume 5, page 12, 2015.

[90] Chunbo Lang, Gong Cheng, Binfei Tu, and Junwei Han. Learning what not to segment: A new perspective on few-shot segmentation. In IEEE/CVF Conference on Computer Vision and Pattern Recognition, pages 8047–8057, 2022.

[91] Yann LeCun, Yoshua Bengio, and Geoffrey Hinton. Deep learning. Nature, 521(7553):436–444, 2015.

[92] Zewen Li, Fan Liu, Wenjie Yang, Shouheng Peng, and Jun Zhou. A survey of convolutional neural networks: Analysis, applications, and prospects. IEEE Transactions on Neural Networks and Learning Systems, 33(12):6999–7019, 2022.

[93] Weibo Liu, Zidong Wang, Xiaohui Liu, Nianyin Zeng, Yurong Liu, and Fuad E. Alsaadi. A survey of deep neural network architectures and their applications. Neurocomputing, 234:11–26, 2017.

[94] Zhiyan Liu, Andrey Bychkov, Chan Kwon Jung, Mitsuyoshi Hirokawa, Shaofeng Sui, SoonWon Hong, Chiung-Ru Lai, Deepali Jain, Sule Canberk, and Kennichi Kakudo. Interobserver and intraobserver variation in the morphological evaluation of noninvasive follicular thyroid neoplasm with papillary-like nuclear features in Asian practice. Pathology International, 69(4):202–210, 2019.

[95] Aurélien Lucchi, Kevin Smith, Radhakrishna Achanta, Graham Knott, and Pascal Fua. Supervoxel-based segmentation of mitochondria in EM image stacks with learned shape features. IEEE Transactions on Medical Imaging, 31(2):474–486, 2012.

[96] Carmen Alina Lupascu, Domenico Tegolo, and Emanuele Trucco. FABC: Retinal vessel segmentation using AdaBoost. IEEE Transactions on Information Technology in Biomedicine, 14(5):1267–1274, 2010.

[97] Bertille Lyonnet. Settlement pattern in the Upper Khabur (NE Syria) from the Achaemenids to the Abbasid Period: Methods and preliminary results from a survey. Continuity and Change in Northern Mesopotamia from the Hellenistic to the Early Islamic Period, pages 349–361, 1996.

[98] Jun Ma, Yuting He, Fei-Fei Li, Lin Han, Chenyu You, and Bo Wang. Segment anything in medical images. Nature Communications, 15(1):654, 2024.

[99] TorchVision maintainers and contributors. TorchVision: PyTorch's computer vision library, November 2016.

[100] Francesca Matrone, Andrea Felicetti, Marina Paolanti, and Roberto Pierdicca. Explaining AI: Understanding deep learning models for heritage point clouds. ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences, pages 207–214, 2023.

[101] Wendy Matthews. Tells in Archaeology. In Encyclopedia of Global Archaeology, pages 10553–10556. Springer, 2020.

[102] Damian J. Matuszewski and Ida-Maria Sintorn. Minimal annotation training for segmentation of microscopy images. In IEEE International Symposium on Biomedical Imaging, pages 387–390, 2018.

[103] Bjoern H. Menze and Jason A. Ur. Mapping patterns of long-term settlement in Northern Mesopotamia at a large scale. Proceedings of the National Academy of Sciences, 109(14):E778–E787, 2012.

[104] Bjoern H. Menze, Jason A. Ur, and Andrew G. Sherratt. Detection of ancient settlement mounds. Photogrammetric Engineering & Remote Sensing, 72(3):321–327, 2006.

[105] Shaobo Min, Xuejin Chen, Zheng-Jun Zha, Feng Wu, and Yongdong Zhang. A two-stream mutual attention network for semi-supervised biomedical segmentation with noisy labels. In AAAI Conference on Artificial Intelligence, volume 33, pages 4578–4585, 2019.

[106] Shervin Minaee, Yuri Boykov, Fatih Porikli, Antonio Plaza, Nasser Kehtarnavaz, and Demetri Terzopoulos. Image segmentation using deep learning: A survey. IEEE Transactions on Pattern Analysis and Machine Intelligence, 44(7):3523–3542, 2022.

[107] Robert Munro Monarch. Human-in-the-loop machine learning: Active learning and annotation for human-centered AI. Simon and Schuster, 2021.

[108] John Ashworth Nelder and Robert Wedderburn. Generalized linear models. Journal of the Royal Statistical Society Series A: Statistics in Society, 135(3):370–384, 1972.

[109] Dong Nie, Yaozong Gao, Li Wang, and Dinggang Shen. ASDNet: Attention based semi-supervised deep networks for medical image segmentation. In Medical Image Computing and Computer Assisted Intervention, pages 370–378. Springer, 2018.

[110] Favour Olaoye, Chris Bell, and Peter Broklyn. Crowdsourcing platforms for collaborative analysis of archaeological big data. EasyChair Preprint 14252, EasyChair, 2024.

[111] Nobuyuki Otsu. A threshold selection method from gray-Level histograms. IEEE Transactions on Systems, Man, and Cybernetics, 9(1):62–66, 1979.

[112] Cheng Ouyang, Carlo Biffi, Chen Chen, Turkay Kart, Huaqi Qiu, and Daniel Rueckert. Self-supervised learning for Few-Shot Medical Image segmentation. IEEE Transactions on Medical Imaging, 41(7):1837–1848, 2022.

[113] William A. Parkinson, Attila Gyucha, Panagiotis Karkanas, Nikos Papadopoulos, Georgia Tsartsidou, Apostolos Sarris, Paul R. Duffy, and Richard W. Yerkes. A landscape of tells: Geophysics and microstratigraphy at two Neolithic tell sites on the Great Hungarian Plain. Journal of Archaeological Science: Reports, 19:903–924, 2018.

[114] Adam Paszke, Sam Gross, Francisco Massa, Adam Lerer, James Bradbury, Gregory Chanan, Trevor Killeen, Zeming Lin, Natalia Gimelshein, Luca Antiga, Alban Desmaison, Andreas Köpf, Edward Yang, Zach DeVito, Martin Raison, Alykhan Tejani, Sasank Chilamkurthy, Benoit Steiner, Lu Fang, Junjie Bai, and Soumith Chintala. PyTorch: An imperative style, high-performance deep learning library. In International Conference on Neural Information Processing Systems, pages 8026–8037. Curran Associates Inc., 2019.

[115] Giacomo Patrucco and Francesco Setragno. Multiclass semantic segmentation for digitisation of movable heritage using deep learning techniques. Virtual Archaeology Review, 12(25):85, 2021.

[116] Daniël M. Pelt and James A. Sethian. A mixed-scale dense convolutional neural network for image analysis. Proceedings of the National Academy of Sciences, 115(2):254–259, 2018.

[117] Liying Peng, Lanfen Lin, Hongjie Hu, Yue Zhang, Huali Li, Yutaro Iwamoto, Xian-Hua Han, and Yen-Wei Chen. Semi-supervised learning for semantic segmentation of emphysema with partial annotations. IEEE Journal of Biomedical and Health Informatics, 24(8):2327–2336, 2020.

[118] Catherine Perlès. A case study in Early Neolithic settlement patterns: Eastern Thessaly. In The Early Neolithic in Greece: The First Farming Communities in Europe, Cambridge World Archaeology, pages 121–151. Cambridge University Press, 2001.

[119] Graham Philip, Daniel Donoghue, Anthony Beck, and Nikolaos Galiatsatos. CORONA satellite photography: An archaeological application from the Middle East. Antiquity, 76(291):109–118, 2002.

[120] Tran Minh Quan, David Grant Colburn Hildebrand, and Won-Ki Jeong. FusionNet: A deep fully residual convolutional neural network for image segmentation in connectomics. Frontiers in Computer Science, 3, 2021.

[121] Martin Rajchl, Matthew C. H. Lee, Ozan Oktay, Konstantinos Kamnitsas, Jonathan Passerat-Palmbach, Wenjia Bai, Mellisa Damodaram, Mary A. Rutherford, Joseph V. Hajnal, Bernhard Kainz, and Daniel Rueckert. DeepCut: Object segmentation from bounding box annotations using convolutional neural networks. IEEE Transactions on Medical Imaging, 36(2):674–683, 2017.

[122] Kate Rakelly, Evan Shelhamer, Trevor Darrell, Alexei A. Efros, and Sergey Levine. Few-Shot segmentation propagation with guided networks, 2018. arXiv:1806.07373 [cs].

[123] Pengzhen Ren, Yun Xiao, Xiaojun Chang, Po-Yao Huang, Zhihui Li, Brij B. Gupta, Xiaojiang Chen, and Xin Wang. A survey of deep active learning. ACM Computing Surveys, 54(9):180:1–180:40, 2021.

[124] Denise Rey and Markus Neuhäuser. Wilcoxon-signed-rank test. In International Encyclopedia of Statistical Science, pages 1658–1659. Springer, 2011.

[125] Olaf Ronneberger, Philipp Fischer, and Thomas Brox. U-Net: Convolutional networks for biomedical image segmentation. In Medical Image Computing and Computer-Assisted Intervention, pages 234–241. Springer, 2015.

[126] Arlene Miller Rosen. Cities of clay: The geoarcheology of tells. Prehistoric Archeology and Ecology Series. University of Chicago Press, 1986.

[127] Abhijit Guha Roy, Shayan Siddiqui, Sebastian Pölsterl, Nassir Navab, and Christian Wachinger. 'Squeeze & excite' guided few-shot segmentation of volumetric images. Medical Image Analysis, 59:101587, 2020.

[128] Walther Sallaberger and Jason A. Ur. Tell Beydar/Nabada in its regional setting. In Third millennium cuneiform texts from Tell Beydar (seasons 1996-2002), Subartu 12, pages 51–71. Brepols, 2004.

[129] Ramprasaath R. Selvaraju, Michael Cogswell, Abhishek Das, Ramakrishna Vedantam, Devi Parikh, and Dhruv Batra. Grad-CAM: Visual explanations from deep networks via gradient-based localization. In IEEE International Conference on Computer Vision, pages 618–626, 2017.

[130] Jean Serra. Image Analysis and Mathematical Morphology. Academic Press, Inc., 1983.

[131] Evan Shelhamer, Jonathan Long, and Trevor Darrell. Fully convolutional networks for semantic segmentation. IEEE Transactions on Pattern Analysis and Machine Intelligence, 39(4):640–651, 2017.

[132] Karen Simonyan and Andrew Zisserman. Very deep convolutional networks for large-scale image recognition. In International Conference on Learning Representations, pages 1–14. Computational and Biological Learning Society, 2015.

[133] Abraham George Smith, Eusun Han, Jens Petersen, Niels Alvin Faircloth Olsen, Christian Giese, Miriam Athmann, Dorte Bodin Dresbøll, and Kristian Thorup-Kristensen. RootPainter: Deep learning segmentation of biological images with corrective annotation. The New Phytologist, 236(2):774–791, 2022.

[134] Andrew Smith. Image segmentation scale parameter optimization and land cover classification using the Random Forest algorithm. Journal of Spatial Science, 55(1):69–79, 2010.

[135] Stefan L. Smith. A morphological typology for the "Kranzhügel" of the Greater Western Jazira and its impact upon interpretations of Early Bronze Age north-eastern Syria. Archaeological Research in Asia, 29:100339, 2022.

[136] Maja Somrak, Sašo Džeroski, and Žiga Kokalj. Learning to classify structures in ALS-derived visualizations of ancient Maya settlements with CNN. Remote Sensing, 12(14):2215, 2020.

[137] Carsen Stringer, Tim Wang, Michalis Michaelos, and Marius Pachitariu. Cellpose: A generalist algorithm for cellular segmentation. Nature Methods, 18(1):100–106, 2021.

[138] Liyan Sun, Chenxin Li, Xinghao Ding, Yue Huang, Zhong Chen, Guisheng Wang, Yizhou Yu, and John Paisley. Few-shot medical image segmentation using a global correlation network with discriminative embedding. Computers in Biology and Medicine, 140:105067, 2022.

[139] Charles Sutton and Andrew McCallum. An introduction to conditional random fields. Foundations and Trends® in Machine Learning, 4(4):267–373, 2012.

[140] David Svoboda, Michal Kozubek, and Stanislav Stejskal. Generation of digital phantoms of cell nuclei and simulation of image formation in 3D image cytometry. Cytometry Part A, 75A(6):494–509, 2009.

[141] Hao Tang, Xingwei Liu, Shanlin Sun, Xiangyi Yan, and Xiaohui Xie. Recurrent mask refinement for few-shot medical image segmentation. In IEEE/CVF International Conference on Computer Vision, pages 3918–3928, 2021.

[142] Martina Tenzer, Giada Pistilli, Alex Bransden, and Alex Shenfield. Debating AI in Archaeology: Applications, implications, and ethical considerations. Internet Archaeology, (67), 2024.

[143] Thanh Tran, Lam Binh Minh, Suk-Hwan Lee, and Ki-Ryong Kwon. Blood cell count using deep learning semantic segmentation, 2019.

[144] Øivind Due Trier, David C. Cowley, and Anders Ueland Waldeland. Using deep neural networks on airborne laser scanning data: Results from a case study of semi-automatic mapping of archaeological topography on Arran, Scotland. Archaeological Prospection, 26(2):165–175, 2019.

[145] Øivind Due Trier, Jarle Hamar Reksten, and Kristian Løseth. Automated mapping of cultural heritage in Norway from airborne lidar data using faster R-CNN. International Journal of Applied Earth Observation and Geoinformation, 95:102241, 2021.

[146] Maurizio Troiano, Eugenio Nobile, Flavia Grignaffini, Fabio Mangini, Marco Mastrogiuseppe, Cecilia Conati Barbaro, and Fabrizio Frezza. A Comparative analysis of machine learning algorithms for identifying cultural and technological groups in archaeological datasets through clustering analysis of homogeneous data. Electronics, 13(14):2752, 2024.

[147] Maurizio Troiano, Eugenio Nobile, Fabio Mangini, Marco Mastrogiuseppe, Cecilia Conati Barbaro, and Fabrizio Frezza. A comparative analysis of the bayesian regularization and Levenberg–Marquardt training algorithms in neural networks for small datasets: A metrics prediction of Neolithic laminar artefacts. Information, 15(5):270, 2024.

[148] Jason A. Ur. Surface collection and offsite studies at Tell Hamoukar, 1999. Iraq, 64:15–43, 2002.

[149] Jason A. Ur. The morphology of Neo-Assyrian cities. Subartu, 6-7:11–22, 2013.

[150] Jason A. Ur and Tony J. Wilkinson. Settlement and economic landscapes of Tell Beydar and its hinterland, pages 305–327. Brepols, 2008.

[151] Ryanne van Dalen, Sultan Mehmood, Paul Verstraten, and Karen van der Wiell. Public funding of science: An international comparison. Technical report, CPB Netherlands Bureau for Economic Policy Analysis, 2014.

[152] Stéfan van der Walt, Johannes L. Schönberger, Juan Nunez-Iglesias, François Boulogne, Joshua D. Warner, Neil Yager, Emmanuelle Gouillart, and Tony Yu. scikit-image: Image processing in Python. PeerJ, 2:e453, 2014.

[153] Ruchika Verma, Neeraj Kumar, Abhijeet Patil, Nikhil Cherian Kurian, Swapnil Rane, Simon Graham, Quoc Dang Vu, Mieke Zwager, Shan E. Ahmed Raza, Nasir Rajpoot, Xiyi Wu, Huai Chen, Yijie Huang, Lisheng Wang, Hyun Jung, G. Thomas Brown, Yanling Liu, Shuolin Liu, Seyed Alireza Fatemi Jahromi, Ali Asghar Khani, Ehsan Montahaei, Mahdieh Soleymani Baghshah, Hamid Behroozi, Pavel Semkin, Alexandr Rassadin, Prasad Dutande, Romil Lodaya, Ujjwal Baid, Bhakti Baheti, Sanjay Talbar, Amirreza Mahbod, Rupert Ecker, Isabella Ellinger, Zhipeng Luo, Bin Dong, Zhengyu Xu, Yuehan Yao, Shuai Lv, Ming Feng, Kele Xu, Hasib Zunair, Abdessamad Ben Hamza, Steven Smiley, Tang-Kai Yin, Qi-Rui Fang, Shikhar Srivastava, Dwarikanath Mahapatra,

Lubomira Trnavska, Hanyun Zhang, Priya Lakshmi Narayanan, Justin Law, Yinyin Yuan, Abhiroop Tejomay, Aditya Mitkari, Dinesh Koka, Vikas Ramachandra, Lata Kini, and Amit Sethi. MoNuSAC2020: A Multi-organ nuclei segmentation and classification challenge. IEEE Transactions on Medical Imaging, 40(12):3413–3423, 2021.

[154] Wouter B. Verschoof-van der Vaart, Karsten Lambers, Wojtek Kowalczyk, and Quentin P.J. Bourgeois. Combining deep learning and location-based ranking for large-scale archaeological prospection of LiDAR data from the Netherlands. ISPRS International Journal of Geo-Information, 9(5):293, 2020.

[155] Tomas Vicar, Jan Balvan, Josef Jaros, Florian Jug, Radim Kolar, Michal Masarik, and Jaromir Gumulec. Cell segmentation methods for label-free contrast microscopy: Review and comprehensive comparison. BMC Bioinformatics, 20(1):360, 2019.

[156] Eugene Vorontsov and Samuel Kadoury. Label noise in segmentation networks: Mitigation must deal with bias. In Deep Generative Models, and Data Augmentation, Labelling, and Imperfections, volume 1, pages 251–258. Springer, 2021.

[157] Athanasios Voulodimos, Nikolaos Doulamis, Anastasios Doulamis, and Eftychios Protopapadakis. Deep learning for computer vision: A brief review. Computational Intelligence and Neuroscience, 2018(1):7068349:1–7068349:13, 2018.

[158] Șerban Vădineanu, Daniël M. Pelt, Oleh Dzyubachyk, and Kees Joost Batenburg. An analysis of the impact of annotation errors on the accuracy of deep learning for cell segmentation. In International Conference on Medical Imaging with Deep Learning, Proceedings of Machine Learning Research, pages 1251–1267. PMLR, 2022.

[159] Șerban Vădineanu, Daniël M. Pelt, Oleh Dzyubachyk, and Kees Joost Batenburg. Reducing manual annotation costs for cell segmentation by upgrading low-quality annotations. Journal of Imaging, 10(7):172, 2024.

[160] Kaixin Wang, Jun Hao Liew, Yingtian Zou, Daquan Zhou, and Jiashi Feng. PANet: Few-shot image semantic segmentation with prototype alignment. In IEEE/CVF International Conference on Computer Vision, pages 9196–9205, 2019.

[161] Shanshan Wang, Cheng Li, Rongpin Wang, Zaiyi Liu, Meiyun Wang, Hongna Tan, Yaping Wu, Xinfeng Liu, Hui Sun, Rui Yang, Xin Liu, Jie Chen, Huihui Zhou, Ismail Ben Ayed, and Hairong Zheng. Annotation-efficient deep learning for automatic medical image segmentation. Nature Communications, 12(1):5915, 2021.

[162] Xiang-Yang Wang, Ting Wang, and Juan Bu. Color image segmentation using pixel wise support vector machine classification. Pattern Recognition, 44(4):777–787, 2011.

[163] Yaqing Wang, Quanming Yao, James T. Kwok, and Lionel M. Ni. Generalizing from a few examples: A survey on few-shot learning. ACM Computing Surveys, 53(3):63:1–63:34, 2020.

[164] Mohammed A. Wani and Bruce G. Batchelor. Edge-region-based segmentation of range images. IEEE Transactions on Pattern Analysis and Machine Intelligence, 16(3):314–319, 1994.

[165] Simon K. Warfield, Kelly H. Zou, and William M. Wells. Simultaneous truth and performance level estimation (STAPLE): An algorithm for the validation of image segmentation. IEEE Transactions on Medical Imaging, 23(7):903–921, 2004.

[166] David Wiesner, David Svoboda, Martin Maška, and Michal Kozubek. CytoPacq: A web-interface for simulating multi-dimensional cell imaging. Bioinformatics, 35(21):4531–4533, 2019.

[167] Tony J. Wilkinson. Regional approaches to Mesopotamian archaeology: The contribution of archaeological surveys. Journal of Archaeological Research, 8(3):219–267, 2000.

[168] Tony J. Wilkinson, John Bintliff, Hans H. Curvers, Paul Halstead, Phillip L. Kohl, Mario Liverani, Joy McCorriston, Joan Oates, Glenn M. Schwartz, Ingolf Thuesen, Harvey Weiss, and Marie-Agnes Courty. The structure and dynamics of dry-farming states in Upper Mesopotamia. Current Anthropology, 35(5):483–520, 1994.

[169] Christoph Witzgall and Roger Fletcher. Practical methods of optimization. In Mathematics of Computation, volume 53, page 768, 1989.

[170] Huisi Wu, Fangyan Xiao, and Chongxin Liang. Dual contrastive learning with anatomical auxiliary supervision for few-shot medical image segmentation. In European Conference on Computer Vision, pages 417–434. Springer, 2022.

[171] Peng Xu, Fred Roosta, and Michael W. Mahoney. Second-order optimization for non-convex machine learning: An empirical study. In SIAM International Conference on Data Mining, Proceedings, pages 199–207. Society for Industrial and Applied Mathematics, 2020.

[172] Yunqiao Yang, Zhiwei Wang, Jingen Liu, Kwang-Ting Cheng, and Xin Yang. Label refinement with an iterative generative adversarial network for boosting retinal vessel segmentation, 2019. arXiv:1912.02589 [eess].

[173] Chi Zhang, Guosheng Lin, Fayao Liu, Rui Yao, and Chunhua Shen. CANet: Class-agnostic segmentation networks with iterative refinement and attentive few-shot learning. In IEEE/CVF Conference on Computer Vision and Pattern Recognition, pages 5212–5221, 2019.

[174] Huahong Zhang, Alessandra M. Valcarcel, Rohit Bakshi, Renxin Chu, Francesca Bagnato, Russell T. Shinohara, Kilian Hett, and Ipek Oguz. Multiple sclerosis lesion segmentation with tiramisu and 2.5D stacked slices. In Medical Image Computing and Computer Assisted Intervention, pages 338–346. Springer, 2019.

[175] Le Zhang, Ryutaro Tanno, Kevin Bronik, Chen Jin, Parashkev Nachev, Frederik Barkhof, Olga Ciccarelli, and Daniel C. Alexander. Learning to segment when experts disagree. In Medical Image Computing and Computer Assisted Intervention, pages 179–190. Springer, 2020.

[176] Le Zhang, Ryutaro Tanno, Mou-Cheng Xu, Chen Jin, Joseph Jacob, Olga Ciccarelli, Frederik Barkhof, and Daniel Alexander. Disentangling human error from ground truth in segmentation of medical images. In Advances in Neural Information Processing Systems, volume 33, pages 15750–15762. Curran Associates, Inc., 2020.

[177] Minqing Zhang, Jiantao Gao, Zhen Lyu, Weibing Zhao, Qin Wang, Weizhen Ding, Sheng Wang, Zhen Li, and Shuguang Cui. Characterizing label errors: Confident learning for noisy-labeled image segmentation. In Medical Image Computing and Computer Assisted Intervention, pages 721–730. Springer, 2020.

[178] Yihuan Zhang, Jun Wang, Xiaonian Wang, and John M. Dolan. Road-segmentation-based curb detection method for self-driving via a 3D-LiDAR sensor. IEEE Transactions on Intelligent Transportation Systems, 19(12):3981–3991, 2018.

[179] Aleksandar Zlateski, Ronnachai Jaroensri, Prafull Sharma, and Fredo Durand. On the importance of label quality for semantic segmentation. In IEEE/CVF Conference on Computer Vision and Pattern Recognition, pages 1479–1487, 2018.

List of Publications

Publications that are part of this thesis:

1. Șerban Vădineanu, Daniël M. Pelt, Oleh Dzyubachyk, and Kees Joost Batenburg. An analysis of the impact of annotation errors on the accuracy of deep learning for cell segmentation. *In International Conference on Medical Imaging with Deep Learning*, Proceedings of Machine Learning Research, pages 1251–1267. PMLR, 2022.

2. Șerban Vădineanu, Daniël M. Pelt, Oleh Dzyubachyk, and Kees Joost Batenburg. Reducing manual annotation costs for cell segmentation by upgrading low-quality annotations. *In International Workshop on Medical Image Learning with Limited and Noisy Data*, Lecture Notes in Computer Science, pages 3-13. Springer, 2023.[∗]

3. Șerban Vădineanu, Daniël M. Pelt, Oleh Dzyubachyk, and Kees Joost Batenburg. Reducing manual annotation costs for cell segmentation by upgrading low-quality annotations. *Journal of Imaging*, 10(7):172, 2024.[∗]

4. Șerban Vădineanu, Tuna Kalayci, Daniël M. Pelt, and Kees Joost Batenburg. Convolutional neural networks and their activations: An exploratory case study on mounded settlements. *Journal of Computer Applications in Archaeology*, 7(1), 2024.

5. Șerban Vădineanu, Daniël M. Pelt, Oleh Dzyubachyk, and Kees Joost Batenburg. From feature maps to few-shot cell segmentation. *In International Workshop on Medical Optical Imaging and Virtual Microscopy Image Analysis*, Lecture Notes in Computer Science. Springer, 2025.[†]

Publications that are not part of this thesis:

1. Șerban Vădineanu and Mitra Nasri. Robust and accurate regression-based techniques for period inference in real-time systems. *Real-Time Systems*, 58(3), 2022.

∗: Paper 3 is the journal extension of Paper 2.
†: Paper 5 was awarded runner-up best paper at MOVI2024 workshop.