Research Sources

### [Combating COVID-19 Using Generative Adversarial Networks and Artificial Intelligence for Medical Images: Scoping Review](https://fau-flvc.primo.exlibrisgroup.com/discovery/fulldisplay?docid=cdi_doaj_primary_oai_doaj_org_article_636bb79ab3a44a2ea0f5401bf45678ac&context=PC&vid=01FALSC_FAU:FAU&lang=en&search_scope=MyInst_and_CI&adaptor=Primo%20Central&tab=Everything&query=any%2Ccontains%2CGenerative%20Adversarial%20Networks%20and%20data%20scarcity&offset=0)

<https://fau-flvc.primo.exlibrisgroup.com/discovery/fulldisplay?docid=cdi_doaj_primary_oai_doaj_org_article_636bb79ab3a44a2ea0f5401bf45678ac&context=PC&vid=01FALSC_FAU:FAU&lang=en&search_scope=MyInst_and_CI&adaptor=Primo%20Central&tab=Everything&query=any,contains,Generative%20Adversarial%20Networks%20and%20data%20scarcity&offset=0>

Hazrat, Ali, and Zubair Shah. “Combating COVID-19 Using Generative Adversarial Networks and Artificial Intelligence for Medical Images: Scoping Review.” *JMIR Medical Informatics*, vol. 10, no. 6, 2022, pp. e37365–e37365, <https://doi.org/10.2196/37365>.

### [Generative Adversarial Networks and Markov Random Fields for oversampling very small training sets](https://fau-flvc.primo.exlibrisgroup.com/discovery/fulldisplay?docid=cdi_proquest_journals_2465477785&context=PC&vid=01FALSC_FAU:FAU&lang=en&search_scope=MyInst_and_CI&adaptor=Primo%20Central&tab=Everything&query=any%2Ccontains%2CGenerative%20Adversarial%20Networks%20and%20data%20scarcity&offset=0)

<https://fau-flvc.primo.exlibrisgroup.com/discovery/fulldisplay?docid=cdi_proquest_journals_2465477785&context=PC&vid=01FALSC_FAU:FAU&lang=en&search_scope=MyInst_and_CI&adaptor=Primo%20Central&tab=Everything&query=any,contains,Generative%20Adversarial%20Networks%20and%20data%20scarcity&offset=0>

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### [Generative adversarial network in medical imaging: A review](https://fau-flvc.primo.exlibrisgroup.com/discovery/fulldisplay?docid=cdi_proquest_miscellaneous_2290984563&context=PC&vid=01FALSC_FAU:FAU&lang=en&search_scope=MyInst_and_CI&adaptor=Primo%20Central&tab=Everything&query=any%2Ccontains%2CGenerative%20Adversarial%20Networks%20and%20data%20scarcity&offset=0)

<https://fau-flvc.primo.exlibrisgroup.com/discovery/fulldisplay?docid=cdi_proquest_miscellaneous_2290984563&context=PC&vid=01FALSC_FAU:FAU&lang=en&search_scope=MyInst_and_CI&adaptor=Primo%20Central&tab=Everything&query=any,contains,Generative%20Adversarial%20Networks%20and%20data%20scarcity&offset=0>

Yi, Xin, et al. “Generative Adversarial Network in Medical Imaging: A Review.” *Medical Image Analysis*, vol. 58, 2019, pp. 101552–101552, <https://doi.org/10.1016/j.media.2019.101552>.

### [A GAN-based image synthesis method for skin lesion classification](https://fau-flvc.primo.exlibrisgroup.com/discovery/fulldisplay?docid=cdi_proquest_miscellaneous_2412990460&context=PC&vid=01FALSC_FAU:FAU&lang=en&search_scope=MyInst_and_CI&adaptor=Primo%20Central&tab=Everything&query=any%2Ccontains%2CGenerative%20Adversarial%20Networks%20and%20data%20scarcity&offset=0)

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### [DEEPFAKE Image Synthesis for Data Augmentation](https://fau-flvc.primo.exlibrisgroup.com/discovery/fulldisplay?docid=cdi_proquest_journals_2700412434&context=PC&vid=01FALSC_FAU:FAU&lang=en&search_scope=MyInst_and_CI&adaptor=Primo%20Central&tab=Everything&query=any%2Ccontains%2CGenerative%20Adversarial%20Networks%20and%20data%20scarcity&offset=0)

<https://fau-flvc.primo.exlibrisgroup.com/discovery/fulldisplay?docid=cdi_proquest_journals_2700412434&context=PC&vid=01FALSC_FAU:FAU&lang=en&search_scope=MyInst_and_CI&adaptor=Primo%20Central&tab=Everything&query=any,contains,Generative%20Adversarial%20Networks%20and%20data%20scarcity&offset=0>

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**Semi-Supervised Learning for limited medical data using Generative Adversarial Network and Transfer Learning**

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**Semi-supervised GAN-based Radiomics Model for Data Augmentation in Breast Ultrasound Mass Classification**

<https://www.sciencedirect.com/science/article/abs/pii/S0169260721000936?via%3Dihub>

Ting Pang, Jeannie Hsiu Ding Wong, Wei Lin Ng, Chee Seng Chan. "Semi-supervised GAN-based Radiomics Model for Data Augmentation in Breast Ultrasound Mass Classification." *Computer Methods and Programs in Biomedicine*, vol. 203, 2021, 106018, ISSN 0169-2607.

**MEDMNIST**

<https://www.nature.com/articles/s41597-022-01721-8#citeas>

Yang, J., Shi, R., Wei, D. *et al.* MedMNIST v2 - A large-scale lightweight benchmark for 2D and 3D biomedical image classification. *Sci Data* **10**, 41 (2023). <https://doi.org/10.1038/s41597-022-01721-8>

**MEDMNIST LABELS:**

<https://github.com/MedMNIST/MedMNIST/blob/main/medmnist/info.py>

**Improving Cancer Detection Classification Performance Using GANs in Breast Cancer Data**

[**https://fau-flvc.primo.exlibrisgroup.com/discovery/fulldisplay?docid=cdi\_ieee\_primary\_10171607&context=PC&vid=01FALSC\_FAU:FAU&lang=en&search\_scope=MyInst\_and\_CI&adaptor=Primo%20Central&tab=Everything&query=any,contains,GANs%20for%20data%20augmentation%20breast%20cancer&offset=0**](https://fau-flvc.primo.exlibrisgroup.com/discovery/fulldisplay?docid=cdi_ieee_primary_10171607&context=PC&vid=01FALSC_FAU:FAU&lang=en&search_scope=MyInst_and_CI&adaptor=Primo%20Central&tab=Everything&query=any,contains,GANs%20for%20data%20augmentation%20breast%20cancer&offset=0)

E. Strelcenia and S. Prakoonwit, "Improving Cancer Detection Classification Performance Using GANs in Breast Cancer Data," in IEEE Access, vol. 11, pp. 71594-71615, 2023, doi: 10.1109/ACCESS.2023.3291336.

**Lung CT image synthesis using GANs**

<https://www.sciencedirect.com/science/article/abs/pii/S0957417422023685?via%3Dihub>

Mendes, José, Tania Pereira, Francisco Silva, Julieta Frade, Joana Morgado, Cláudia Freitas, Eduardo Negrão, et al. “Lung CT Image Synthesis Using GANs.” *Expert systems with applications* vol. 215 (2023): 119350-. <https://doi.org/10.1016/j.eswa.2022.119350>[Get rights and content](https://s100.copyright.com/AppDispatchServlet?publisherName=ELS&contentID=S0957417422023685&orderBeanReset=true)

**A survey on Image Data Augmentation for Deep Learning**

<https://fau-flvc.primo.exlibrisgroup.com/discovery/fulldisplay?docid=cdi_doaj_primary_oai_doaj_org_article_677e4d78a94b48aa897a5c41858b1562&context=PC&vid=01FALSC_FAU:FAU&lang=en&search_scope=MyInst_and_CI&adaptor=Primo%20Central&tab=Everything&query=any,contains,GANs%20for%20data%20augmentation%20lung%20cancer&offset=0>

Shorten, Connor, and Taghi M. Khoshgoftaar. “A Survey on Image Data Augmentation for Deep Learning.” *Journal of big data* 6, no. 1 (2019): 1–48.

<http://dx.doi.org/10.1186/s40537-019-0197-0>

# **Lung cancer CT image generation from a free-form sketch using style-based pix2pix for data augmentation**

<https://fau-flvc.primo.exlibrisgroup.com/discovery/fulldisplay?docid=cdi_doaj_primary_oai_doaj_org_article_2a7a29413eb44f12a4ae27ed9901d102&context=PC&vid=01FALSC_FAU:FAU&lang=en&search_scope=MyInst_and_CI&adaptor=Primo%20Central&tab=Everything&query=any,contains,GANs%20for%20data%20augmentation%20lung%20cancer&offset=0>

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# **Increasing prediction accuracy of pathogenic staging by sample augmentation with a GAN.**

<https://fau-flvc.primo.exlibrisgroup.com/discovery/fulldisplay?docid=cdi_doaj_primary_oai_doaj_org_article_fa8cb78838934b6c9ae56be039cf2fbd&context=PC&vid=01FALSC_FAU:FAU&lang=en&search_scope=MyInst_and_CI&adaptor=Primo%20Central&tab=Everything&query=any,contains,GANs%20for%20data%20augmentation%20lung%20cancer&offset=0>

Kwon, ChangHyuk, Sangjin Park, Soohyun Ko, and Jaegyoon Ahn. “Increasing Prediction Accuracy of Pathogenic Staging by Sample Augmentation with a GAN.” *PloS one* 16, no. 4 (2021): e0250458–e0250458.

# **The (de)biasing effect of GAN-based augmentation methods on skin lesion images**

<https://fau-flvc.primo.exlibrisgroup.com/discovery/fulldisplay?docid=cdi_proquest_journals_2682960105&context=PC&vid=01FALSC_FAU:FAU&lang=en&search_scope=MyInst_and_CI&adaptor=Primo%20Central&tab=Everything&query=any,contains,GANs%20for%20data%20augmentation%20lung%20cancer&offset=10>

Mikołajczyk, Agnieszka, Sylwia Majchrowska, and Sandra Carrasco Limeros. “The (de)Biasing Effect of GAN-Based Augmentation Methods on Skin Lesion Images.” In *ArXiv.Org*. Ithaca: Cornell University Library, arXiv.org, 2022.

**MEDMNIST DATA SET**

CHEST

<https://fau-flvc.primo.exlibrisgroup.com/discovery/fulldisplay?docid=cdi_doaj_primary_oai_doaj_org_article_1b5d1880254149c885f696e5bbd61d1d&context=PC&vid=01FALSC_FAU:FAU&lang=en&search_scope=MyInst_and_CI&adaptor=Primo%20Central&tab=Everything&query=any,contains,GANs%20for%20data%20augmentation%20in%20cardiomegaly&offset=0>

Ciano, G., Andreini, P., Mazzierli, T., Bianchini, M., & Scarselli, F. (2021). A Multi-Stage GAN for Multi-Organ Chest X-ray Image Generation and Segmentation. *Mathematics (Basel)*, *9*(22), 2896-. <https://doi.org/10.3390/math9222896>

CardioNET

<https://fau-flvc.primo.exlibrisgroup.com/discovery/fulldisplay?docid=cdi_doaj_primary_oai_doaj_org_article_fe66360614c1469aae4dcef7663a78f7&context=PC&vid=01FALSC_FAU:FAU&lang=en&search_scope=MyInst_and_CI&adaptor=Primo%20Central&tab=Everything&query=any,contains,GANs%20for%20data%20augmentation%20in%20cardiomegaly&offset=0>

Jafar, A., Hameed, M. T., Akram, N., Waqas, U., Kim, H. S., & Naqvi, R. A. (2022). CardioNet: Automatic Semantic Segmentation to Calculate the Cardiothoracic Ratio for Cardiomegaly and Other Chest Diseases. *Journal of Personalized Medicine*, *12*(6), 988-. <https://doi.org/10.3390/jpm12060988>

In the realm of deep learning and computer vision, the effectiveness of models heavily depends on the availability and diversity of training data. However, in many real-world scenarios, acquiring a sufficient amount of labeled data for model training is a challenging endeavor. This report explores an approach to mitigate the limitations of limited training data by harnessing the power of Generative Adversarial Networks (GANs).

In this study, we delve into the application of GANs for generating synthetic images to augment the training dataset for deep learning models. Specifically, we focus on image classification tasks where the availability of labeled data is scarce. By training a GAN on existing data and generating synthetic images, we aim to bolster the training set, making it more robust and comprehensive.

Our research not only delves into the technical aspects of GAN-based data generation but also explores the implications of using synthetic data on the performance of deep learning models. We analyze the challenges, advantages, and potential biases introduced by this data augmentation technique.

The outcomes of this study provide valuable insights into the feasibility and effectiveness of using GAN-generated synthetic data to improve the performance of deep learning models under data scarcity. This research bridges the gap between limited data availability and the demands of modern machine learning applications, offering a promising avenue for addressing real-world challenges in various domains.

By leveraging the synergy between GANs and deep learning, this work contributes to the ongoing efforts to advance the state of the art in machine learning, opening new possibilities for applications in fields where data scarcity has been a bottleneck.