# C_NMC_2019 Dataset: ALL Challenge dataset of ISBI 2019 (C-NMC 2019)

# Summary

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Acute lymphoblastic leukemia (ALL) constitutes approximately 25% of the pediatric cancers. In general, the task of identifying immature leukemic blasts from normal cells under the microscope is challenging because morphologically the images of the two cells appear similar.

## Challenge is split into 3 separate phases:

- **Train set composition:**

  Total subjects: 73, ALL (cancer): 47, Normal: 26

  Total cell images: 10,661, ALL(cancer): 7272, Normal: 3389
- **Preliminary test set composition:**

  Total subjects: 28, ALL (cancer): 13, Normal: 15

  Total cell images: 1867, ALL(cancer): 1219, Normal: 648
- **Final test set composition:**

  Total subjects: 17, ALL (cancer): 9, Normal: 8

  Total cell images: 2586

## Additional Publications using this dataset:


- Anubha Gupta, Rahul Duggal, Shiv Gehlot, Ritu Gupta, Anvit Mangal, Lalit Kumar, Nisarg Thakkar, and Devprakash Satpathy, "GCTI-SN: Geometry-Inspired Chemical and Tissue Invariant Stain Normalization of Microscopic Medical Images," Medical Image Analysis, vol. 65, Oct 2020. DOI: https://doi.org/10.1016/j.media.2020.101788.
- Rahul Duggal, Anubha Gupta, Ritu Gupta, and Pramit Mallick, "SD-Layer: Stain Deconvolutional Layer for CNNs in Medical Microscopic Imaging," In: Descoteaux M., Maier-Hein L., Franz A., Jannin P., Collins D., Duchesne S. (eds) Medical Image Computing and Computer-Assisted Intervention  MICCAI 2017, MICCAI 2017. Lecture Notes in Computer Science, Part III, LNCS 10435, pp. 435–443. Springer, Cham. DOI: https://doi.org/10.1007/978-3-319-66179-7_50.
- Rahul Duggal, Anubha Gupta, Ritu Gupta, Manya Wadhwa, and Chirag Ahuja, “Overlapping Cell Nuclei Segmentation in Microscopic Images UsingDeep Belief Networks,” Indian Conference on Computer Vision, Graphics and Image Processing (ICVGIP), India, December 2016.


**Data Access**

## Data Access

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**Detailed Description**

## Detailed Description

| Image Statistics | |
|---|---|
| Modalities | Pathology |
| Number of Participants | 118 |
| Number of Studies | 118 |
| Number of Images | 15,135 |
| Images Size (GB) | 10.44 |

Please see the readme for a more detailed description of the dataset: CNMC_readme.pdf

**Citations & Data Usage Policy**

## Citations & Data Usage Policy

Users must abide by the TCIA Data Usage Policy and Restrictions. Attribution should include references to the following citations:

**Data Citation**

Mourya, S., Kant, S., Kumar, P., Gupta, A., & Gupta, R. (2019). **ALL Challenge dataset of ISBI 2019 (C-NMC 2019) (Version 1) [dataset].** The Cancer Imaging Archive. https://doi.org/10.7937/tcia.2019.dc64i46r

**Publication Citation**

Gehlot, S., Gupta, A., & Gupta, R. (2020). **SDCT-AuxNet: DCT augmented stain deconvolutional CNN with auxiliary classifier for cancer diagnosis.** In Medical Image Analysis (Vol. 61, p. 101661). Elsevier BV. https://doi.org/10.1016/j.media.2020.101661

**TCIA Citation**

Clark K, Vendt B, Smith K, Freymann J, Kirby J, Koppel P, Moore S, Phillips S, Maffitt D, Pringle M, Tarbox L, Prior F. **The Cancer Imaging Archive (TCIA): Maintaining and Operating a Public Information Repository**, Journal of Digital Imaging, Volume 26, Number 6, December, 2013, pp 1045-1057. DOI: 10.1007/s10278-013-9622-7

## Other Publications Using This Data

The following publications are recommended by the data submitters that may be useful to researchers utilizing this collection:

- Gupta, R., Gehlot, S., & Gupta, A. (2022). C-NMC: B-lineage acute lymphoblastic leukaemia: A blood cancer dataset. Medical Engineering & Physics, 103. doi: https://doi.org/10.1016/j.medengphy.2022.103793
- Goswami, S., Mehta, S., Sahrawat, D., Gupta, A., & Gupta, R. (2020). Heterogeneity Loss to Handle Intersubject and Intrasubject Variability in Cancer (Version 2). ICLR workshop on Affordable AI in healthcare, 2020. arXiv preprint https://doi.org/10.48550/arXiv.2003.03295
- Gehlot, S., Gupta, A., & Gupta, R. (2021). A CNN-based unified framework utilizing projection loss in unison with label noise handling for multiple Myeloma cancer diagnosis. Medical image analysis, 72, 102099. doi:https://doi.org/10.1016/j.media.2021.102099
- Anubha Gupta, Rahul Duggal, Shiv Gehlot, Ritu Gupta, Anvit Mangal, Lalit Kumar, Nisarg Thakkar, and Devprakash Satpathy, "GCTI-SN: Geometry-Inspired Chemical and Tissue Invariant Stain Normalization of Microscopic Medical Images," Medical Image Analysis, vol. 65, Oct 2020. DOI: https://doi.org/10.1016/j.media.2020.101788.
- Rahul Duggal, Anubha Gupta, Ritu Gupta, and Pramit Mallick, "SD-Layer: Stain Deconvolutional Layer for CNNs in Medical Microscopic Imaging," In: Descoteaux M., Maier-Hein L., Franz A., Jannin P., Collins D., Duchesne S. (eds) Medical Image Computing and Computer-Assisted Intervention MICCAI 2017, MICCAI 2017. Lecture Notes in Computer Science, Part III, LNCS 10435, pp. 435–443. Springer, Cham. DOI: https://doi.org/10.1007/978-3-319-66179-7_50.
- Rahul Duggal, Anubha Gupta, Ritu Gupta, Manya Wadhwa, and Chirag Ahuja, “Overlapping Cell Nuclei Segmentation in Microscopic Images Using Deep Belief Networks,” Indian Conference on Computer Vision, Graphics and Image Processing (ICVGIP), India, December 2016.

TCIA maintains a list of publications which leverage TCIA data. If you have a manuscript you'd like to add please contact TCIA's Helpdesk.

1. Ciga, O., Xu, T., & Martel, A. L. (2022). Self supervised contrastive learning for digital histopathology. Machine Learning with Applications, 7. doi:https://doi.org/10.1016/j.mlwa.2021.100198
2. Jawahar, M., H, S., L, J. A., & Gandomi, A. H. (2022). ALNett: A cluster layer deep convolutional neural network for acute lymphoblastic leukemia classification. Comput Biol Med, 148, 105894. doi:https://doi.org/10.1016/j.compbiomed.2022.105894
3. Mohammed, K. K., Hassanien, A. E., & Afify, H. M. (2023). Refinement of ensemble strategy for acute lymphoblastic leukemia microscopic images using hybrid CNN-GRU-BiLSTM and MSVM classifier. Neural Computing and Applications, 35(23), 17415-17427. doi:https://doi.org/10.1007/s00521-023-08607-9
4. Rastogi, P., Khanna, K., & Singh, V. (2022). LeuFeatx: Deep learning-based feature extractor for the diagnosis of acute leukemia from microscopic images of peripheral blood smear. Comput Biol Med, 142, 105236. doi:https://doi.org/10.1016/j.compbiomed.2022.105236
5. Rizki Firdaus, M., Ema, U., & Dhani, A. (2023). Classification of Acute Lymphoblastic Leukemia based on White Blood Cell Images using InceptionV3 Model. Jurnal RESTI (Rekayasa Sistem dan Teknologi Informasi), 7(4), 947-952. doi:https://doi.org/10.29207/resti.v7i4.5182
6. Talaat, F. M., & Gamel, S. A. (2023). A2M-LEUK: attention-augmented algorithm for blood cancer detection in children. Neural Computing and Applications, 35(24), 18059-18071. doi:https://doi.org/10.1007/s00521-023-08678-8

**Versions**

## Version 1 (Current): Updated 2019/03/26

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