

# HistoSyn: Histomorphology-Focused Pathology Image Synthesis

— Supplementary Materials —

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**Overview.** In the supplementary material, we provide more details of the dataset, histomorphology attributes, and text prompts for training.

Table 1: The Liver-NAS [4] contains an image tile dataset extracted from patients with Non-alcoholic fatty liver disease (NAFLD). Each image tile has been assigned a label indicating the histological findings it represents: others, inflammation, ballooning, and steatosis.

Dataset	#images	Resolution	Magnification	#classes
Liver-NAS [4]	5864	224 x 224	40x	4

Table 2: Inspired by the [3], we consider nuclei and white regions observed in liver pathology images. The histomorphology attributes (index 1-7) are extracted with the scikit-image library [2].

Spatial attributes (1)	The spatial arrangement of nuclei
Spatial attributes (2)	The spatial arrangement of white regions
Spatial attributes (3)	The spatial arrangement of nuclei around white regions
Spatial attributes (4)	The spatial arrangement of white regions around nuclei
Morphology attributes (5)	The area of white regions
Morphology attributes (6)	The eccentricity of white regions
Morphology attributes (7)	The perimeters of white regions

**Text Prompt for Training.** The text prompt used in methods are as follows:

- Baseline: histology image of <label> tissue.
- Morphology-enriched [1]: histology image of <label> tissue, morphology type <index>.

- HistoSyn (Ours):
  - others: histology image of others tissue, with normal nuclei density <attribute 1> <attribute 2> <attribute 3> <attribute 4>, indicating balanced cellular arrangement. Highlight absence of white regions, which no specific alterations like lipid droplets or swelling <attribute 5> <attribute 6> <attribute 7>. These features distinguish others by showing typical tissue appearance without notable white regions.
  - inflammation: histology image of inflammation tissue, with high nuclei density <attribute 1> <attribute 2> <attribute 3> <attribute 4>, indicating crowded cells from an inflammatory response. Highlight absence of white regions, which reflects dense cellular infiltration without lipid droplets <attribute 5> <attribute 6> <attribute 7>. These features distinguish inflammation by showing cellular proliferation, no white spaces
  - ballooning: histology image of ballooning tissue, with sparse nuclei density <attribute 1> <attribute 2> <attribute 3> <attribute 4>, indicating scattered nuclei due to cell swelling. Highlight presence of white regions, which indicate swollen hepatocytes <attribute 5> <attribute 6> <attribute 7>. These features distinguish ballooning by showing cell damage with clear white areas
  - steatosis: histology image of steatosis tissue, with sparse nuclei density <attribute 1> <attribute 2> <attribute 3> <attribute 4>, indicating less crowded cells due to lipid accumulation. Highlight presence of white regions, which represent lipid droplets in hepatocytes <attribute 5> <attribute 6> <attribute 7>. These features distinguish steatosis by showing fat accumulation with swollen, pale cells

## References

1. Osorio, P., Jimenez-Perez, G., Montalt-Tordera, J., Hooge, J., Duran-Ballester, G., Singh, S., Radbruch, M., Bach, U., Schroeder, S., Siudak, K., et al.: Latent diffusion models with image-derived annotations for enhanced ai-assisted cancer diagnosis in histopathology. arXiv preprint arXiv:2312.09792 (2023)
2. Van der Walt, S., Schönberger, J.L., Nunez-Iglesias, J., Boulogne, F., Warner, J.D., Yager, N., Gouillart, E., Yu, T.: scikit-image: image processing in python. *PeerJ* **2**, e453 (2014)
3. Yin, C., Liu, S., Shao, R., Yuen, P.C.: Focusing on clinically interpretable features: selective attention regularization for liver biopsy image classification. In: Medical Image Computing and Computer Assisted Intervention–MICCAI 2021: 24th International Conference, Strasbourg, France, September 27–October 1, 2021, Proceedings, Part V 24. pp. 153–162. Springer (2021)
4. Zhou, Y.J., Gao, F., Liu, W.Y., Wong, G.L.H., Mahadeva, S., Raihan Nik Mustapha, N., Wang, X.D., Chan, W.K., Wong, V.W.S., Zheng, M.H.: Screening for compensated advanced chronic liver disease using refined baveno vi elastography cutoffs in asian patients with nonalcoholic fatty liver disease. *Alimentary pharmacology & therapeutics* **54**(4), 470–480 (2021)