

**Enhancing Spatial Transcriptomics Analysis by
Integrating Image-Aware Deep Learning Methods**

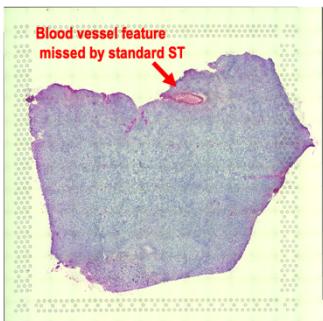
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Steven Finkbeiner³, and David W. Craig^{1,4,5†}

SUPPLEMENTARY MATERIAL

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Supplementary Fig. 1.

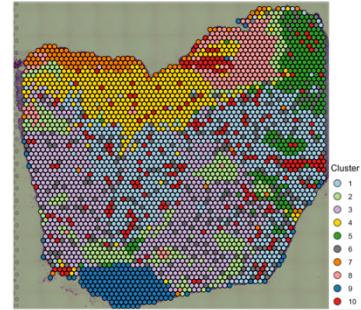
A. H&E image of glioma section ST



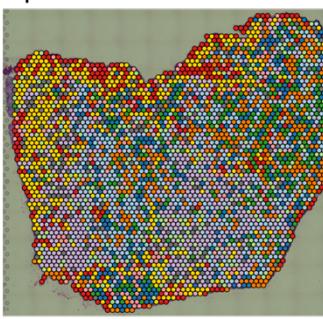
B. Gene Expression Only Clustering



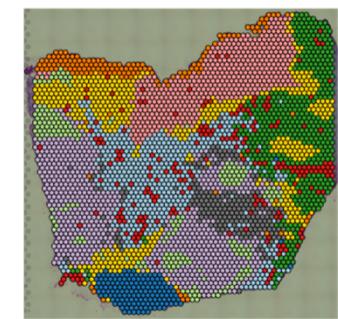
C. stMIC



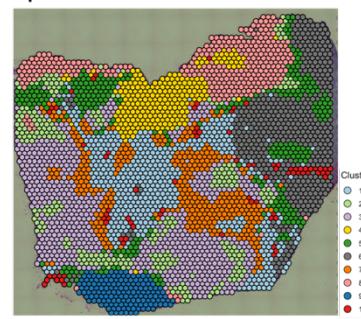
D. SpaCell



E. stLearn

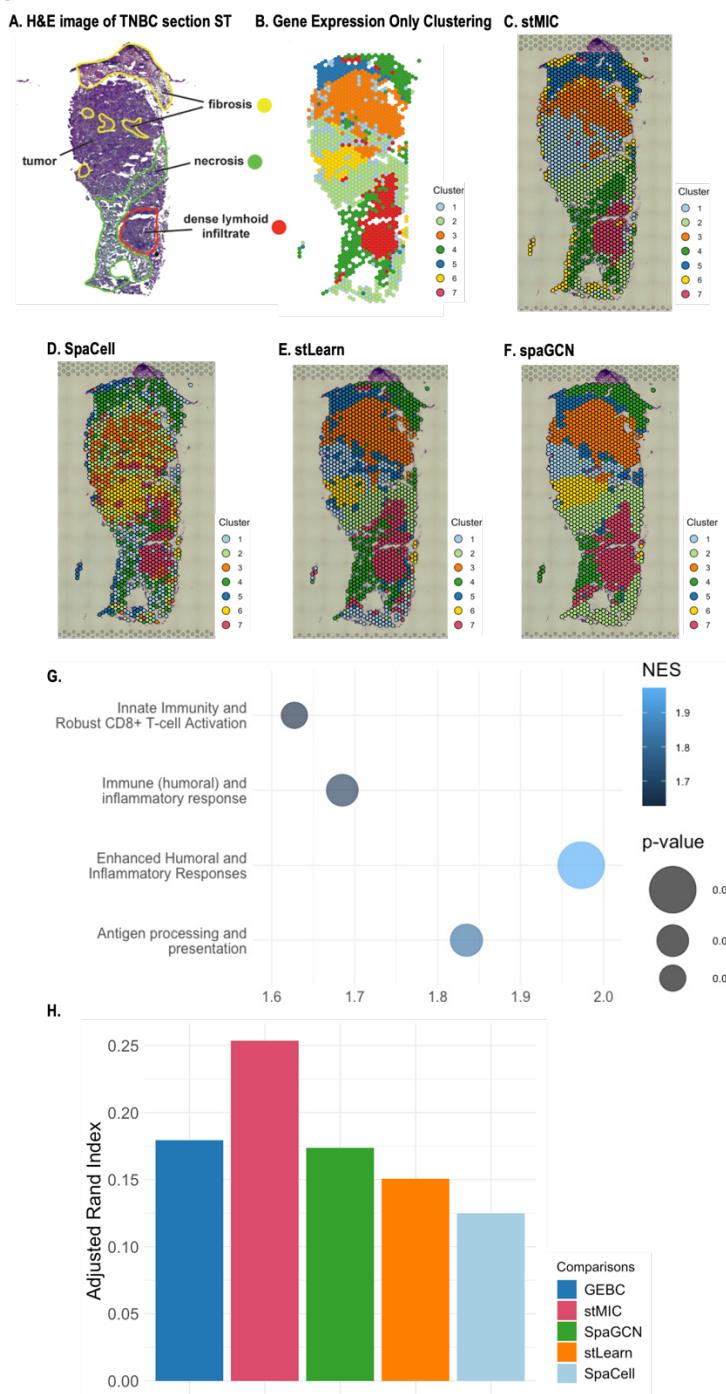


F. spaGCN



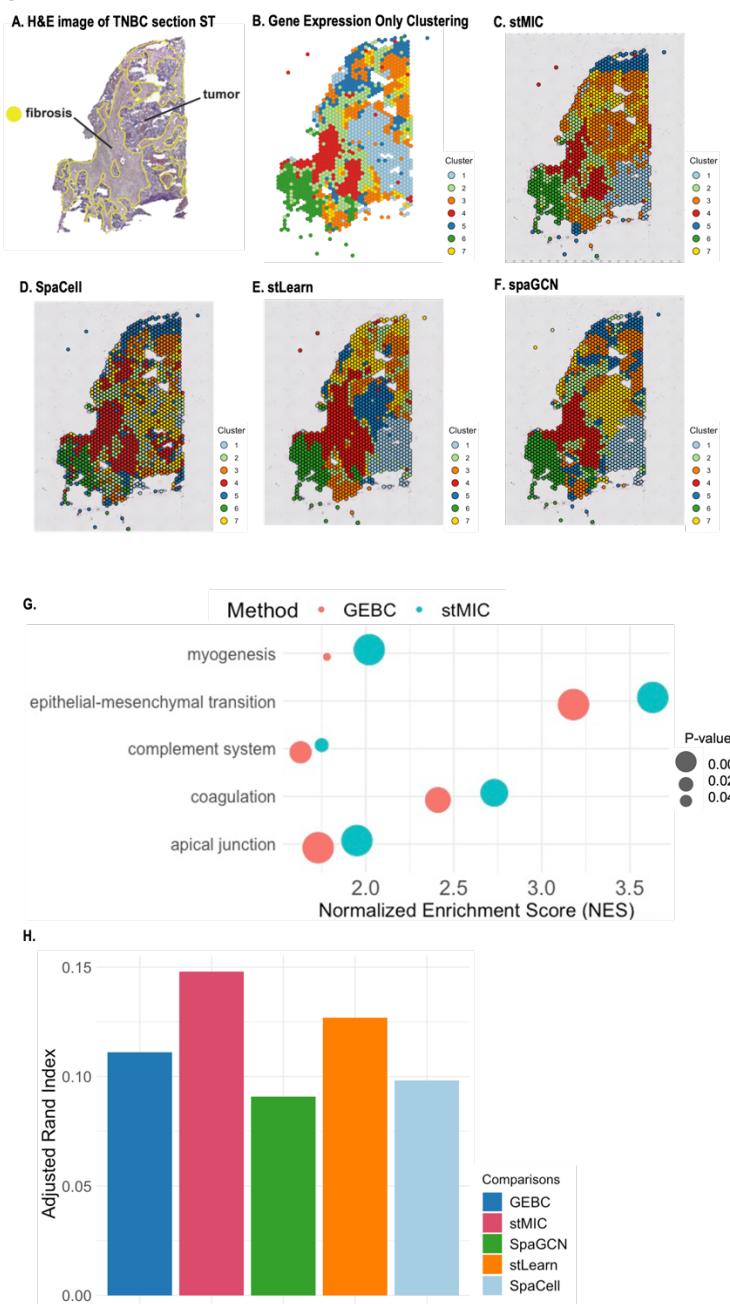
Supplementary Fig. 1. Comparative analysis of clustering methods and spatial expression patterns of FFD1. (A) Haematoxylin and eosin (H&E) staining image of Glioblastoma sample. (B-C) Spatial domains identified by gene expression only clustering and stMIC clustering method. (D-F) Spatial domains identified by SpaCell, stLearn, and spaGCN method.

Supplementary Fig. 1.



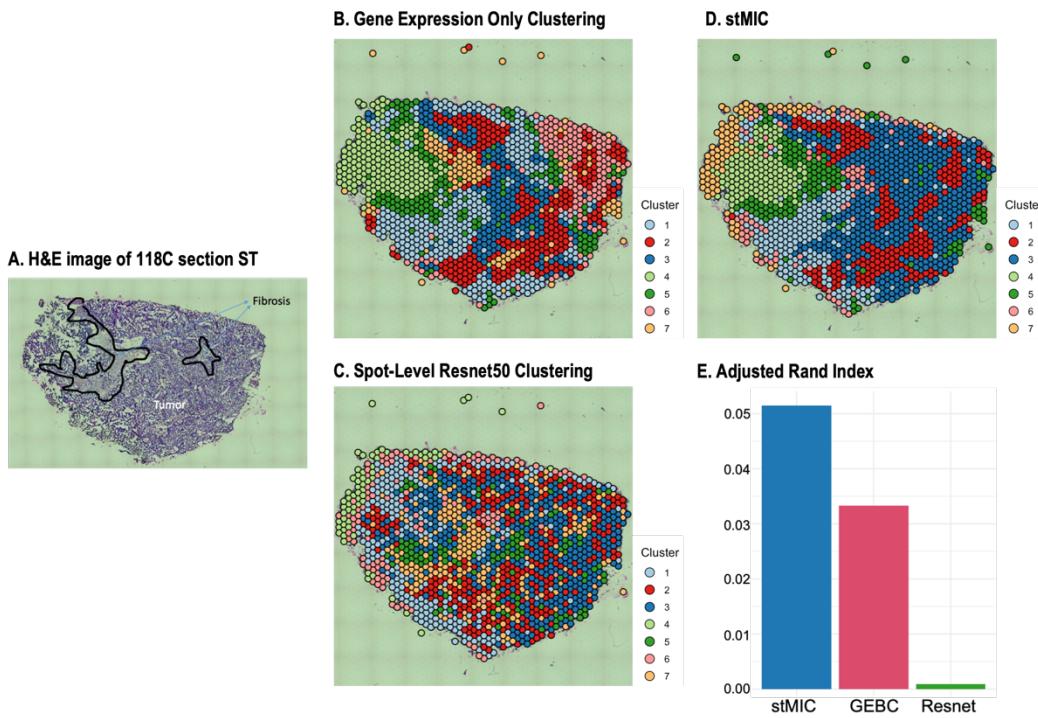
Supplementary Fig. 2. Comparative analysis of clustering methods and spatial expression patterns of 120D. (A) Haematoxylin and eosin (H&E) staining image of triple negative breast cancer sample. (B-C) Spatial domains identified by gene expression only clustering and stMIC clustering method. (D-F) Spatial domains identified by SpaCell, stLearn, and spaGCN method. (G) Top enriched pathways in cluster 4 with their corresponding enrichment scores. (H) Adjusted Rand Index (ARI) in gene expression based (GEBC), stMIC, SpaGCN, stLearn, and SpaCell clustering methods determined sections against the ground truth labels (pathologist annotation).

Supplementary Fig. 3.



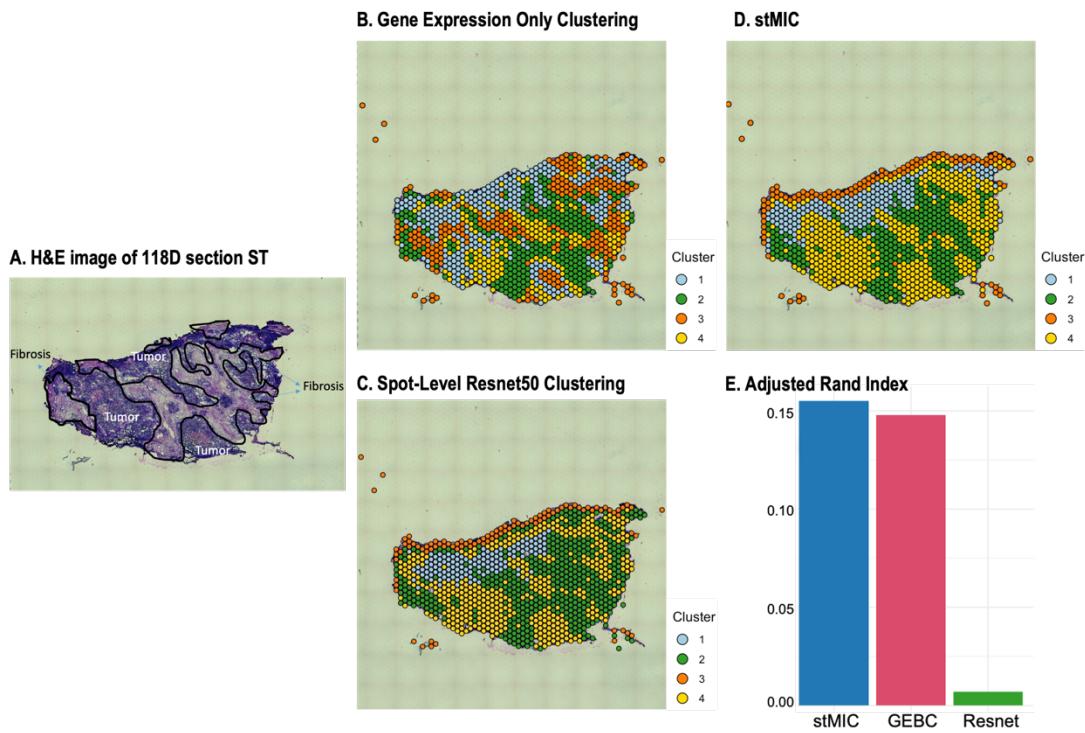
Supplementary Fig. 3. Comparative analysis of clustering methods and spatial expression patterns of 94D. (A) Haematoxylin and eosin (H&E) staining image of triple negative breast cancer sample. (B-C) Spatial domains identified by gene expression only clustering and stMIC clustering method. (D-F) Spatial domains identified by SpaCell, stLearn, and spaGCN method. (G) Top enriched Hallmark pathways in cluster 4 with their corresponding enrichment scores. (H) Adjusted Rand Index (ARI) in gene expression based (GEBC), stMIC, SpaGCN, stLearn, and SpaCell clustering methods determined sections against the ground truth labels (pathologist annotation).

Supplementary Fig. 4.



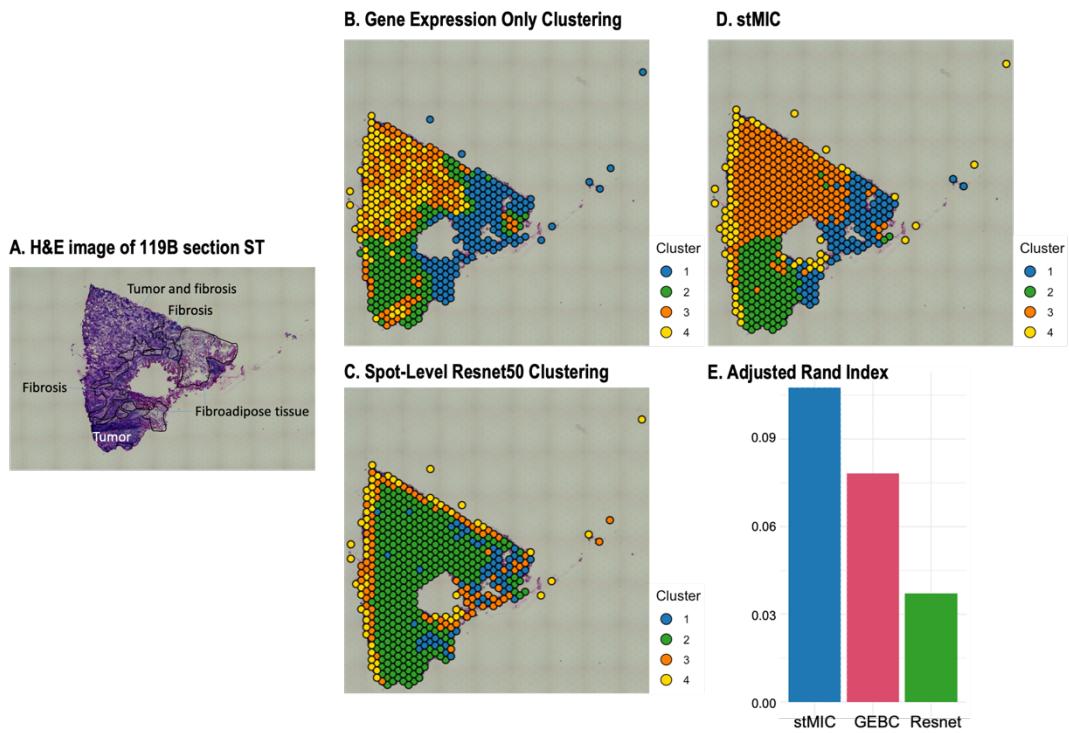
Supplementary Fig. 4. Comparative analysis of clustering methods and spatial expression patterns of 118C. (A) Haematoxylin and eosin (H&E) staining image of triple negative breast cancer sample. (B-D) Spatial domains identified by gene expression only clustering, ResNet-50 feature clustering and stMIC clustering method. (E) Adjusted Rand Index (ARI) in GEBC, ResNet-50 and stMIC clustering methods determined sections against pathologist annotation.

Supplementary Fig. 5.



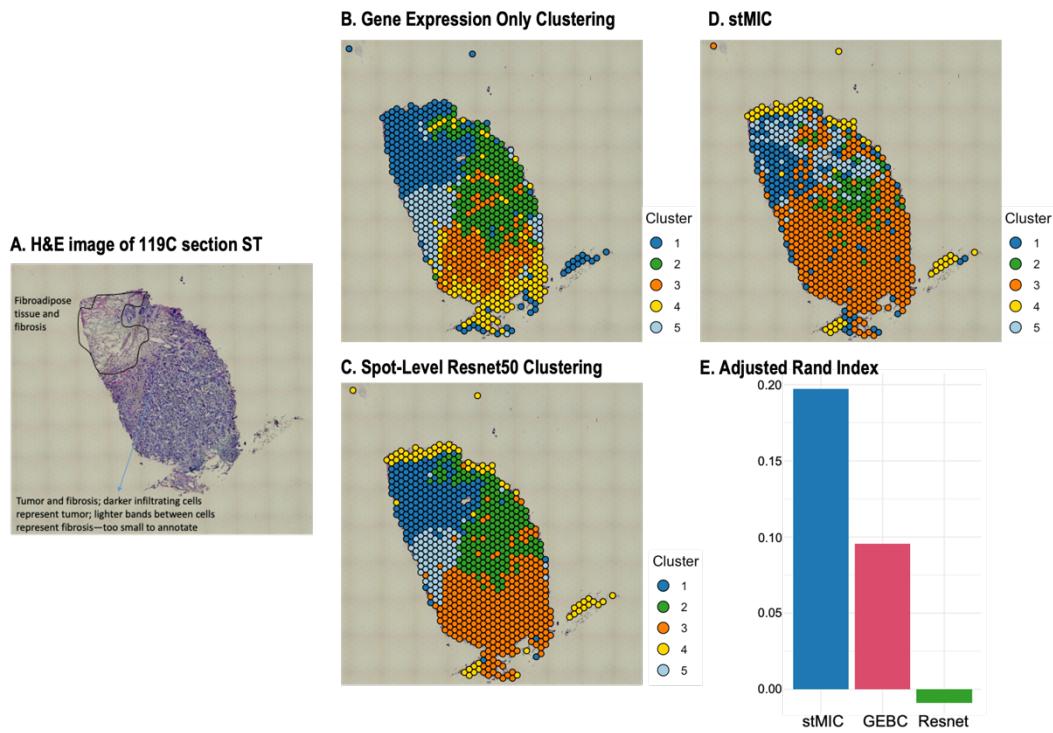
Supplementary Fig. 5. Comparative analysis of clustering methods and spatial expression patterns of 118D. (A) Haematoxylin and eosin (H&E) staining image of triple negative breast cancer sample. (B-D) Spatial domains identified by gene expression only clustering, ResNet-50 feature clustering and stMIC clustering method. (E) Adjusted Rand Index (ARI) in GEBC, ResNet-50 and stMIC clustering methods determined sections against pathologist annotation.

Supplementary Fig. 6.



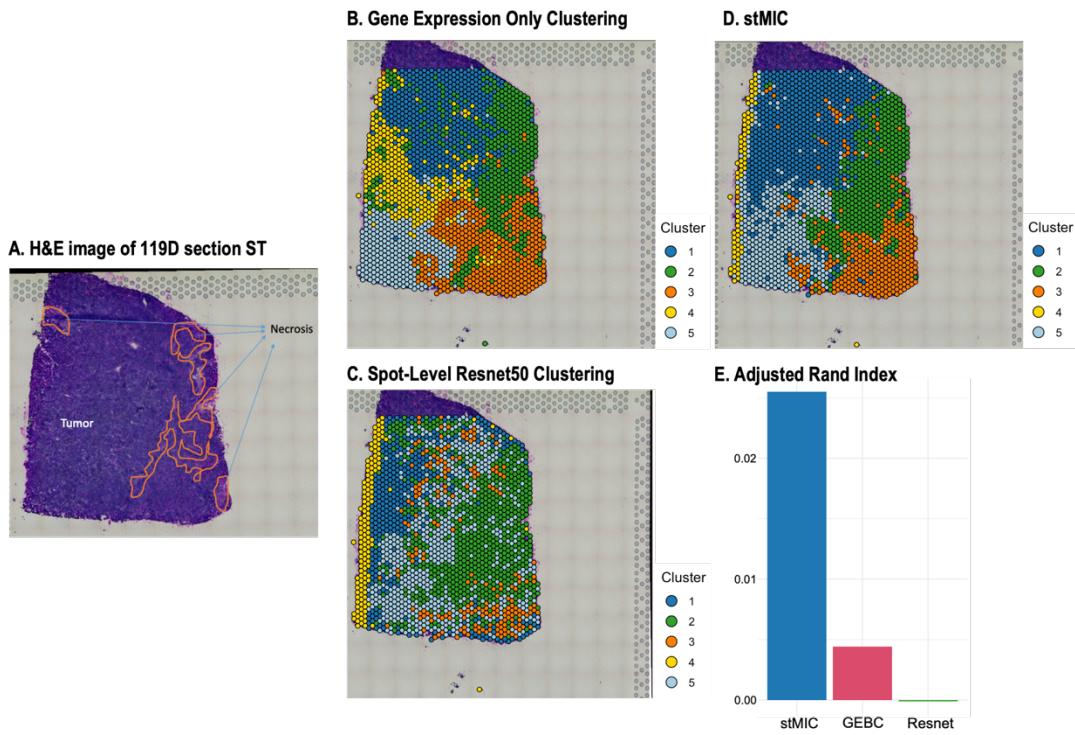
Supplementary Fig. 6. Comparative analysis of clustering methods and spatial expression patterns of 119B. (A) Haematoxylin and eosin (H&E) staining image of triple negative breast cancer sample. (B-D) Spatial domains identified by gene expression only clustering, ResNet-50 feature clustering and stMIC clustering method. (E) Adjusted Rand Index (ARI) in GEBC, ResNet-50 and stMIC clustering methods determined sections against pathologist annotation.

Supplementary Fig. 7.



Supplementary Fig. 7. Comparative analysis of clustering methods and spatial expression patterns of 119C. (A) Haematoxylin and eosin (H&E) staining image of triple negative breast cancer sample. (B-D) Spatial domains identified by gene expression only clustering, ResNet-50 feature clustering and stMIC clustering method. (E) Adjusted Rand Index (ARI) in GEBC, ResNet-50 and stMIC clustering methods determined sections against pathologist annotation.

Supplementary Fig. 8.



Supplementary Fig. 8. Comparative analysis of clustering methods and spatial expression patterns of 119D. (A) Haematoxylin and eosin (H&E) staining image of triple negative breast cancer sample. (B-D) Spatial domains identified by gene expression only clustering, ResNet-50 feature clustering and stMIC clustering method. (E) Adjusted Rand Index (ARI) in GEBC, ResNet-50 and stMIC clustering methods determined sections against pathologist annotation.