Pathorchestra Platform

A Multimodal Medical AI and Data Collaboration Platform

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Project overview

Industry Challenges

Uneven distribution of medical resources

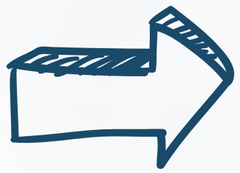
Shortage of doctors in remote areas makes it difficult for patients to access timely diagnostic services

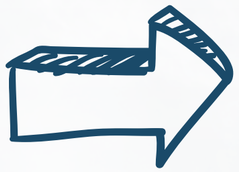
Diagnosing efficiency bottlenecks

Traditional processes rely on manual labour, and the core task in the initial stages of AI healthcare is to optimise diagnostic pathways and improve efficiency

Data siloing

Fragmented and insufficiently standardised healthcare data hinders AI model development and landing.





Product design concept

A

MediFusion

Lightweight AI Consultation to Bridge Primary Care Gaps

B

SPMM

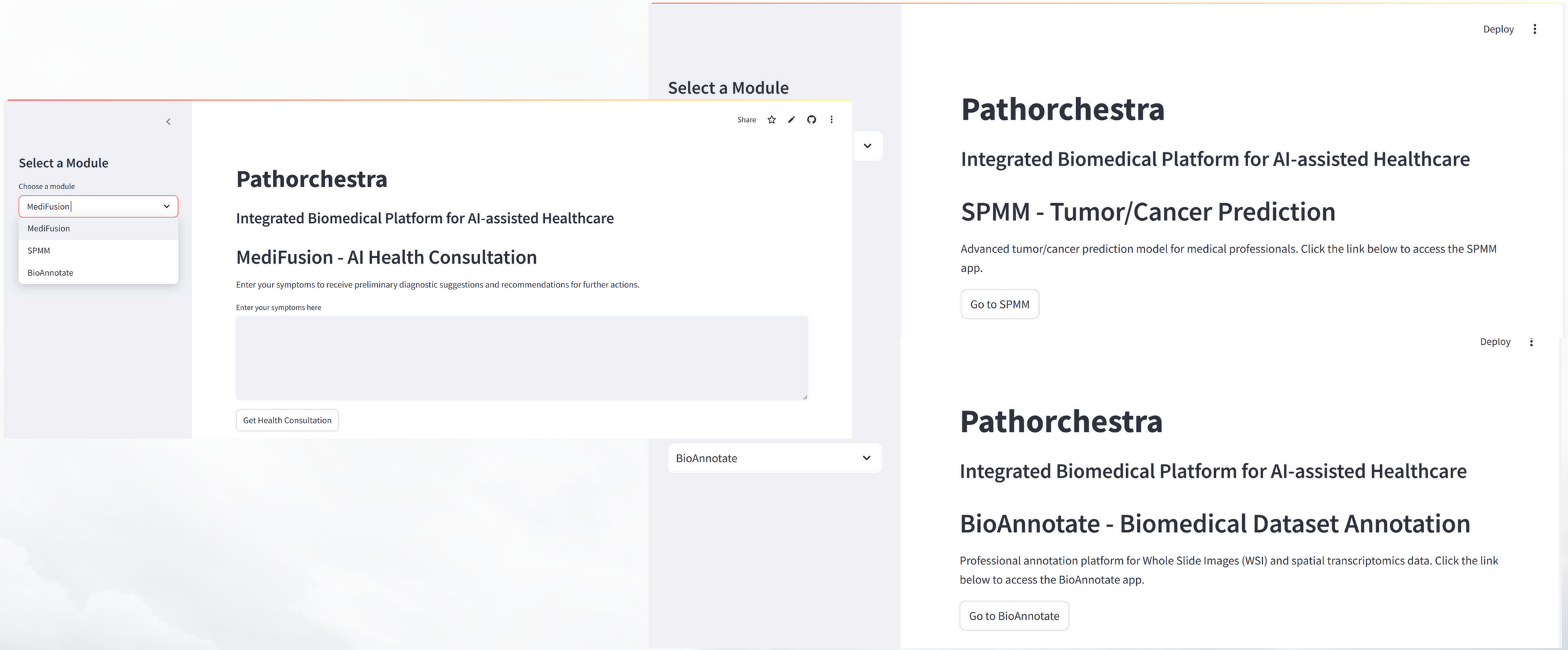
Multimodal Tumor Prediction for Enhanced Diagnostic Accuracy

C

BioAnnotate

Annotation Tools to Create Pathology Datasets

Module Chosen



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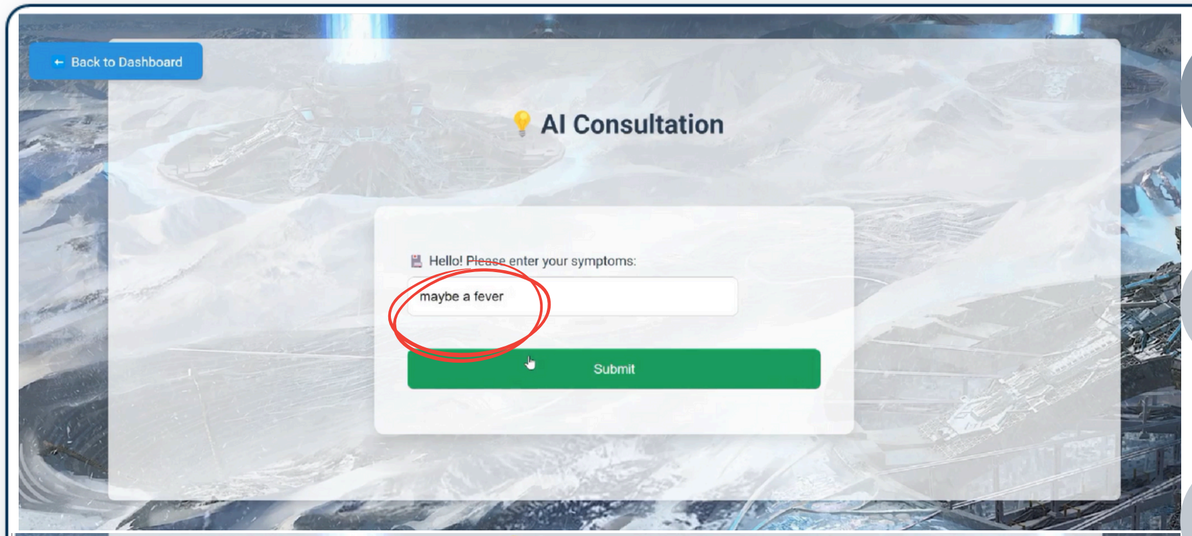
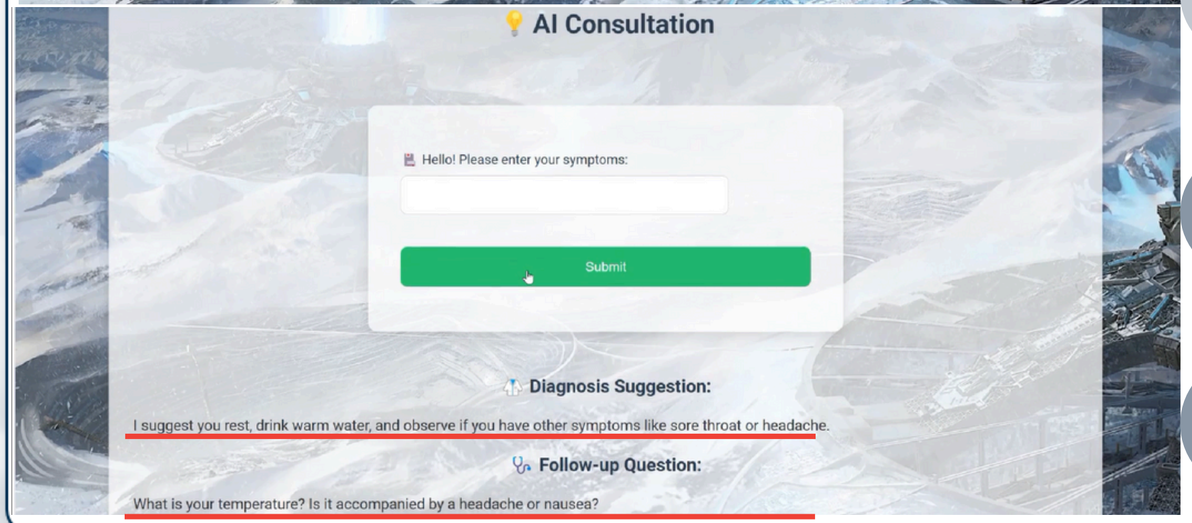
MediFusion (AI Consultation)





symptom input

↓

encrypted transmission

↓

model inference

↓

tiered recommendations

↓

make detailed enquiries

AI medical consultation

Tech Stack:
Bio-ChatGLM localized deployment + Symptom-Disease Knowledge Graph.
Mockup: Mobile interface (symptom input and results page).

SPMM (Multimodal Tumor/cancer Prediction)

Multimodal Data Integration

Spatial transcriptomic data (gene expression + spatial coordinates), pathological images (WSI/H&E staining), clinical text (pathology reports).

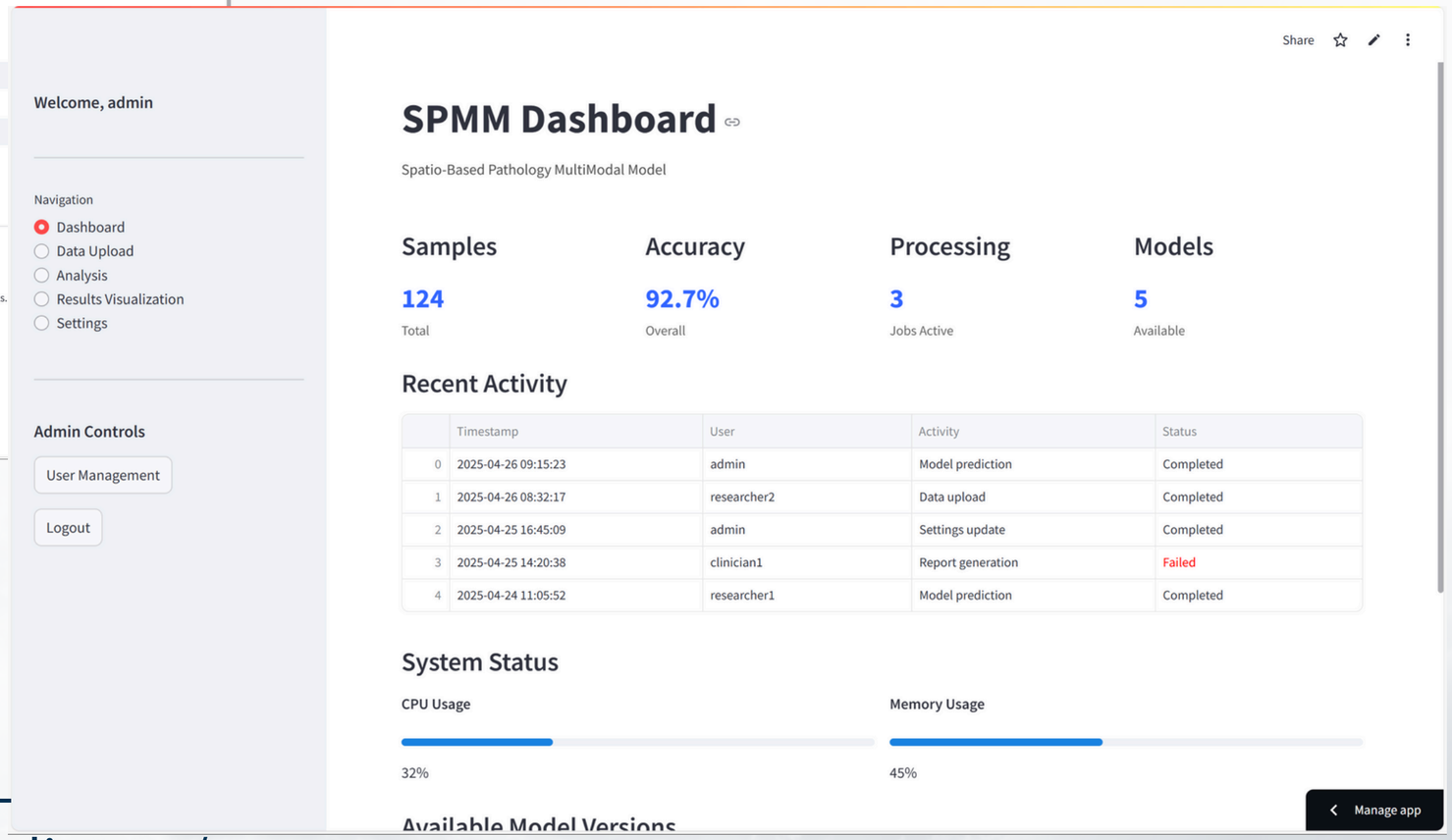
Dynamic Alignment & Prediction

Contrastive learning aligns cross-modal features to predict tumor type, grade, and prognosis.

Interpretability Analysis

Visualize attention weights to demonstrate key associations between image regions and gene expression.

SPMM (Multimodal Tumor/cancer Prediction)



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BioAnnotate (Data Annotation)

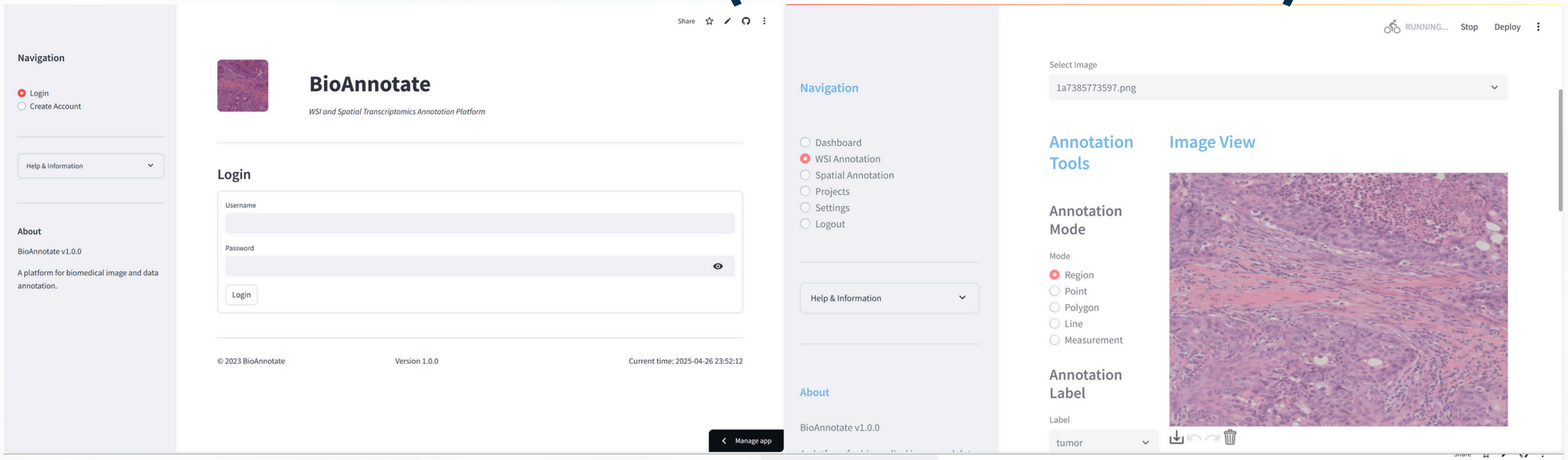
Specific Annotation Platform for WSI and ST data:

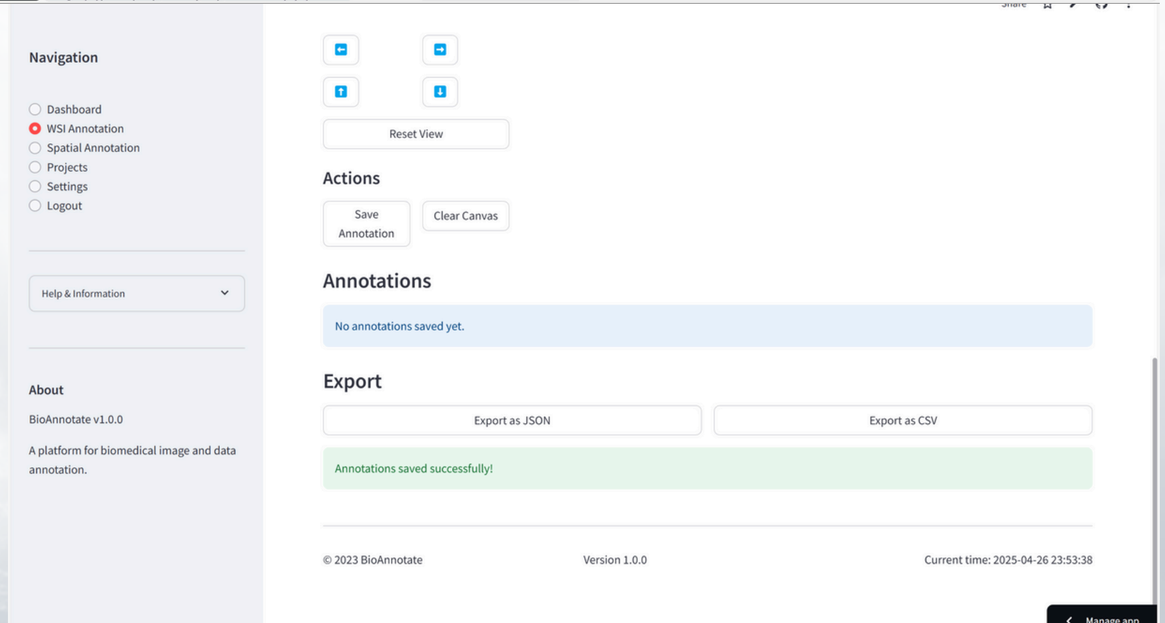
Annotation Type	Supported Tools	Output Formats
WSI Region	Polygon/Brush Tools	COCO/ASAP
Spatial Omics	Gene Expression Overlay	H5AD + GeoJSON

Collaboration Workflow:
Annotate → Review → As Dataset for Training SPMM → Feedback

Alleviate scarcity of biomedical models → ST datasets

BioAnnotate (Data Annotation)





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Technical Architecture and Innovations

1 **Frontend**

Streamlit unified interface.

2 **Backend**

Flask microservices + RBAC dynamic permissions.

3 **AI Layer**

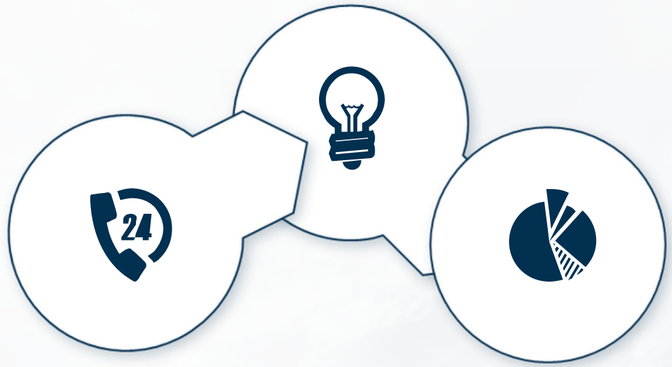
PyTorch multimodal training pipeline.

4 **Data Layer**

Distributed storage (WSI slices + Spatial omics database).

Privacy-Performance Balance

Federated learning for
localized model updates



Multimodal Dynamic Alignment

Cross-modal contrastive loss design

Annotation-Training Loop

BioAnnotate
↔
SPMM bidirectional data flow

Challenges, Future & Vision

Current Challenges

Multimodal Data Alignment Complexity

- High GPU resource demand for cross-modal feature fusion (Optimizing distributed training pipelines)

Annotation Quality Control

- Developing automated QC tools (e.g., inconsistency detection in WSI annotations)

Regulatory Compliance

- Partnering with tier-1 hospitals for clinical certification

Future Roadmap

Technical Expansion

- Extend cancer types (Lung/Liver) + Drug response prediction models

Ecosystem Building

- Co-develop treatment response DB with pharma partners (e.g., Roche, Novartis)

Business Models

- B2B: Hospital subscriptions (Cases-based pricing)
- B2G: Public health partnerships
- B2R: Research data revenue sharing

Empowering Global Health Through Data-Driven Medicine

Thank you!