



Towards Evidence-Linked 3D Part Grounding for Digitized Natural History Specimens

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Introduction

- Natural history collections contain records, images, 3D models, publications, and expert interpretations.
- We aim to link these resources to anatomical parts on a specimen's 3D surface.

Problem and motivation

- **Spatial specificity**
Specimen references leave anatomical locations unspecified.
- **Evidence scope**
Passages may concern the specimen, its taxon, or comparative material.
- **Objective**
Link visible anatomical parts to passages, source locations, and evidence scope.

Materials

3D meshes and associated resources for anatomical part grounding. Availability varies by specimen.



3D meshes

Specimen surface geometry



Collection records

Catalogue IDs, labels and locality



Images and media

Specimen photographs and illustrations



Research literature

Articles, books and species descriptions



Field notes and reports

Expedition notes and specialist reports

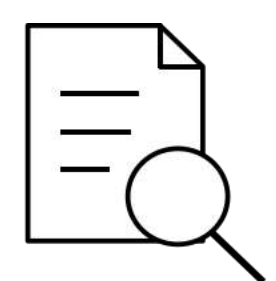


Expert annotations

Identifications and interpretive notes

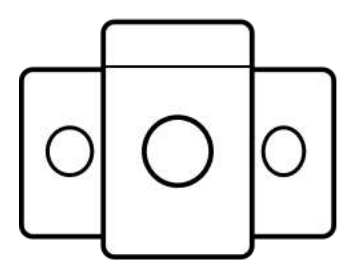
...

Methodology



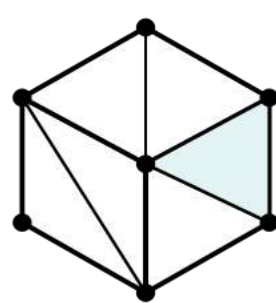
Part-Conditioned Retrieval

Retrieve passages relevant to the target part.



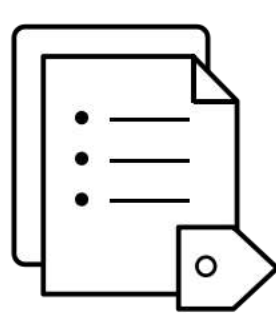
Controlled Multi-View Segmentation

Identify the target part across multiple views.



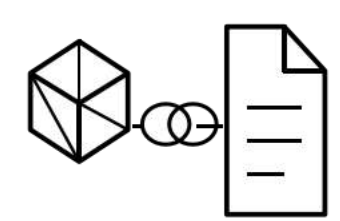
Mask Lifting and Voting

Map the identified regions onto the 3D specimen.



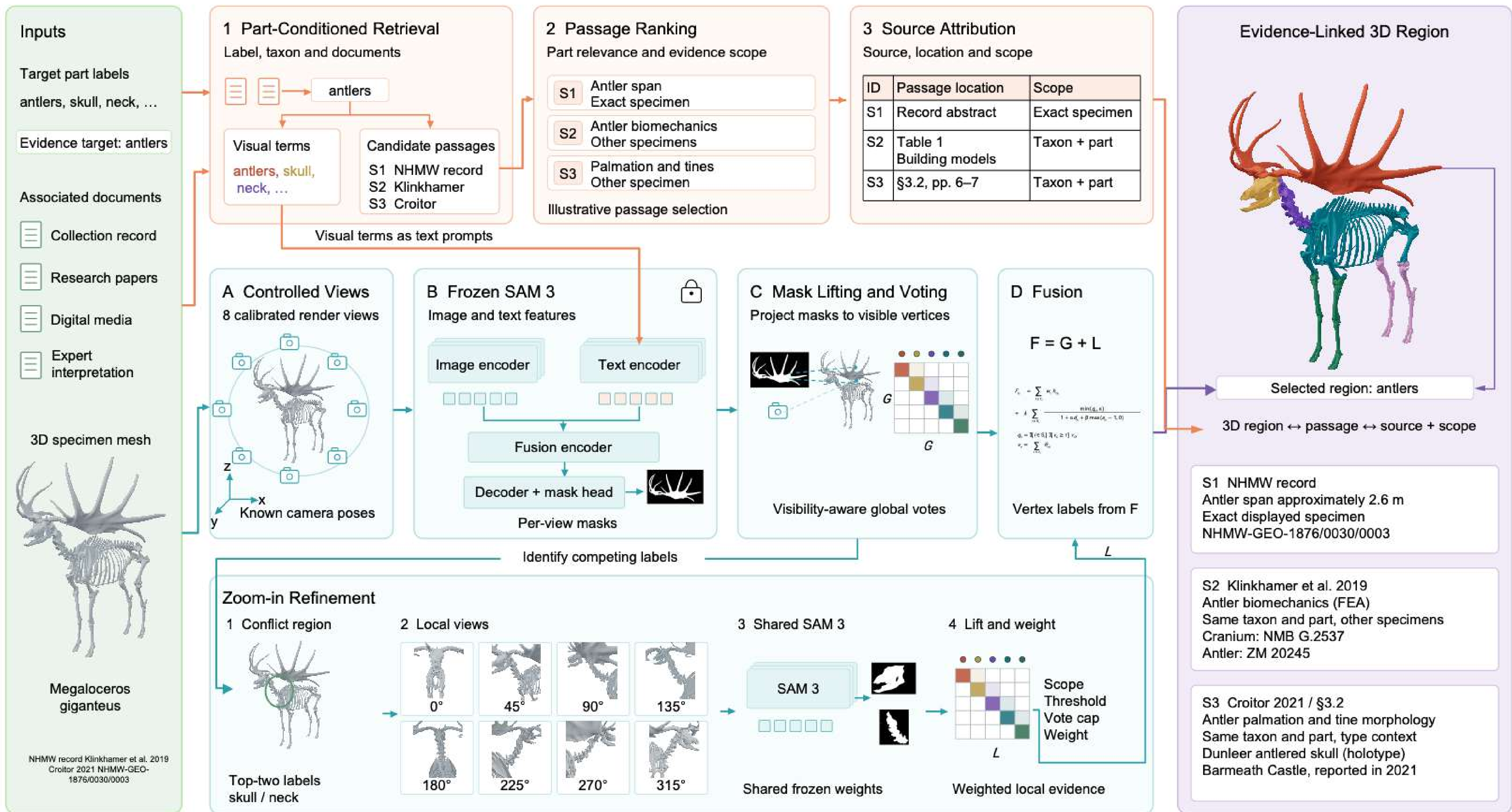
Passage Ranking and Source Attribution

Organize retrieved passages with their sources and scope.

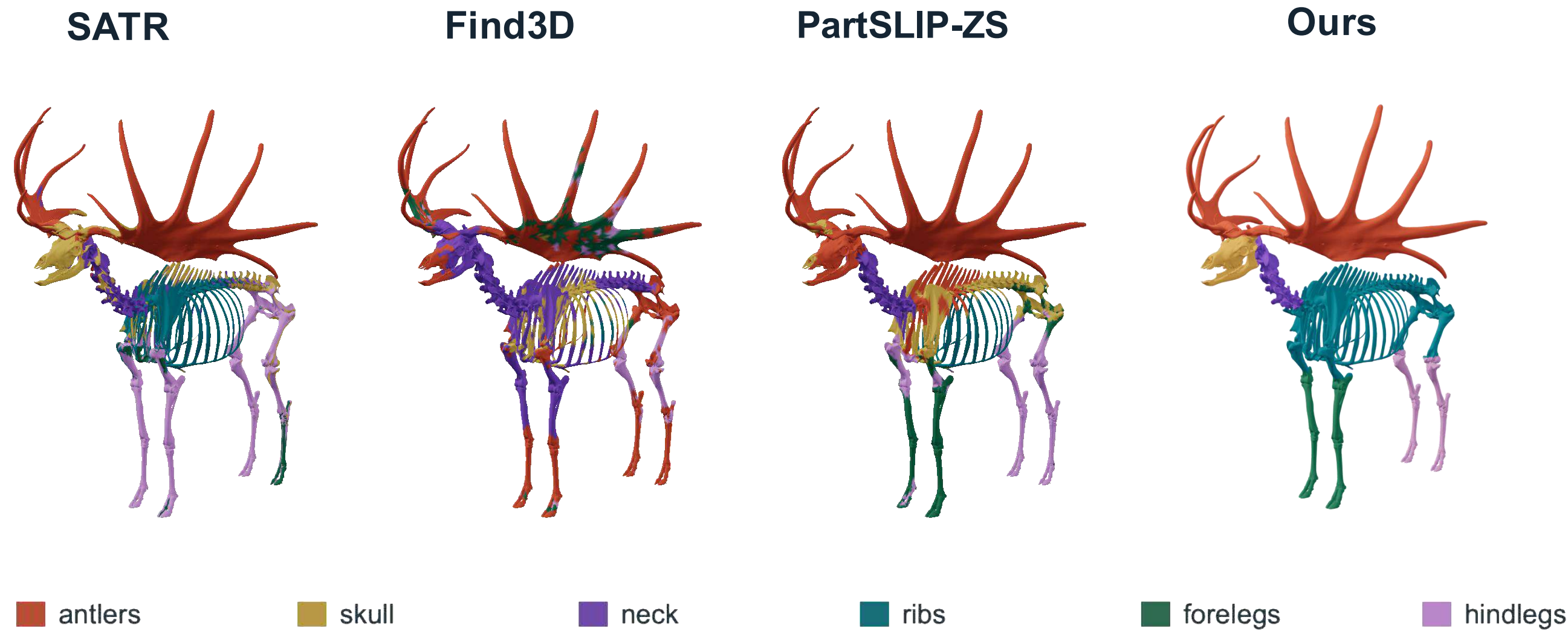


Evidence-Linked 3D Region

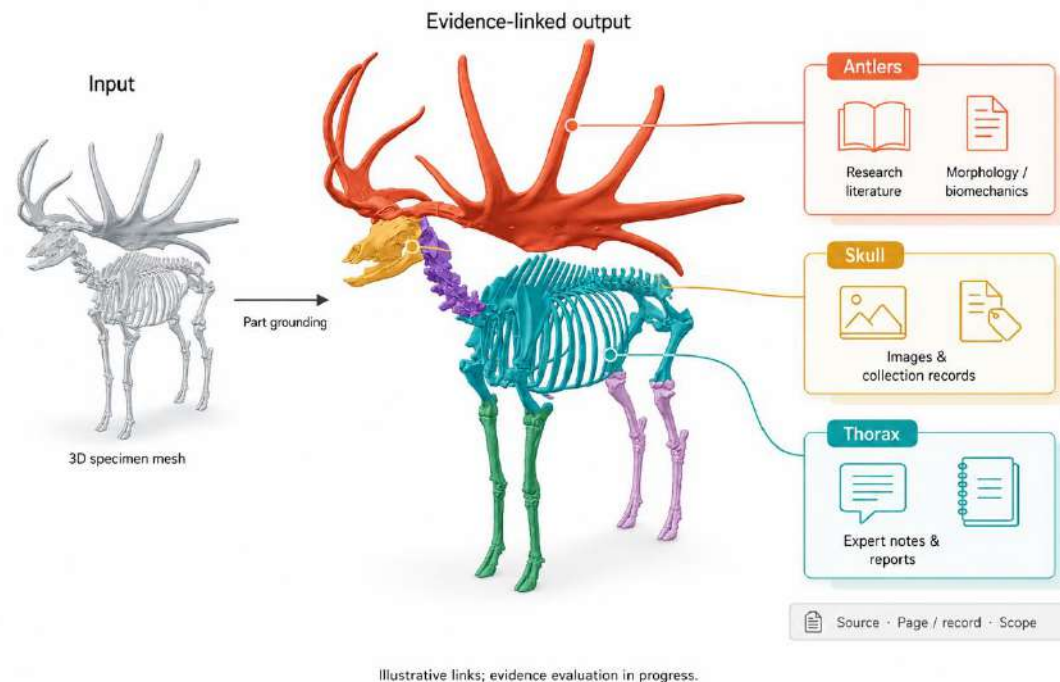
Link the 3D region to traceable documentary evidence.



Results



Method	Config.	Official mIoU-12	Instance mIoU	Body IoU	OA
SATR	Default	52.31	49.84	38.66	66.12
SATR	Selected	56.49	53.00	39.97	69.19
Find3D	Default	45.59	52.38	43.20	65.68
Find3D	Selected	50.51	55.28	45.41	69.16
PartSLIP-ZS	Default	47.57	47.94	39.08	62.12
PartSLIP-ZS	Selected	50.63	51.06	41.41	64.73
Ours	Main	57.66	58.69	46.35	73.82



Conclusion

- Combine zero-shot 3D part segmentation with passage retrieval, ranking, and source attribution.
- Initial segmentation experiments support further development.
- Natural-history adaptation and evaluation of evidence ranking and attribution remain ongoing.
- Connect anatomical regions with traceable documentary evidence.

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