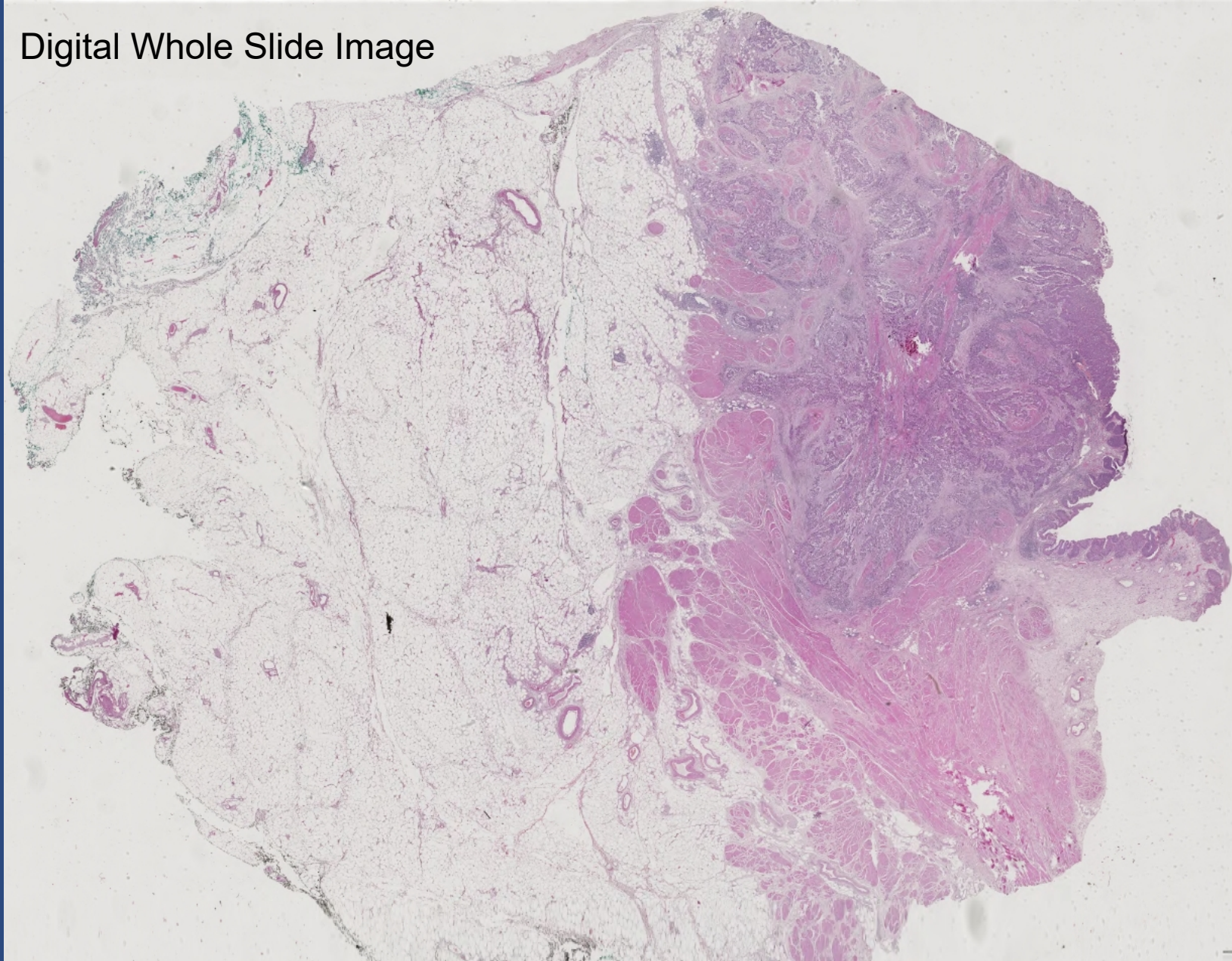


HALCYON

Erich Bremer
June 12, 2025

What problem(s) are we trying to solve?

Digital Whole Slide Image

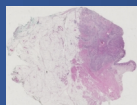


100K x 100K

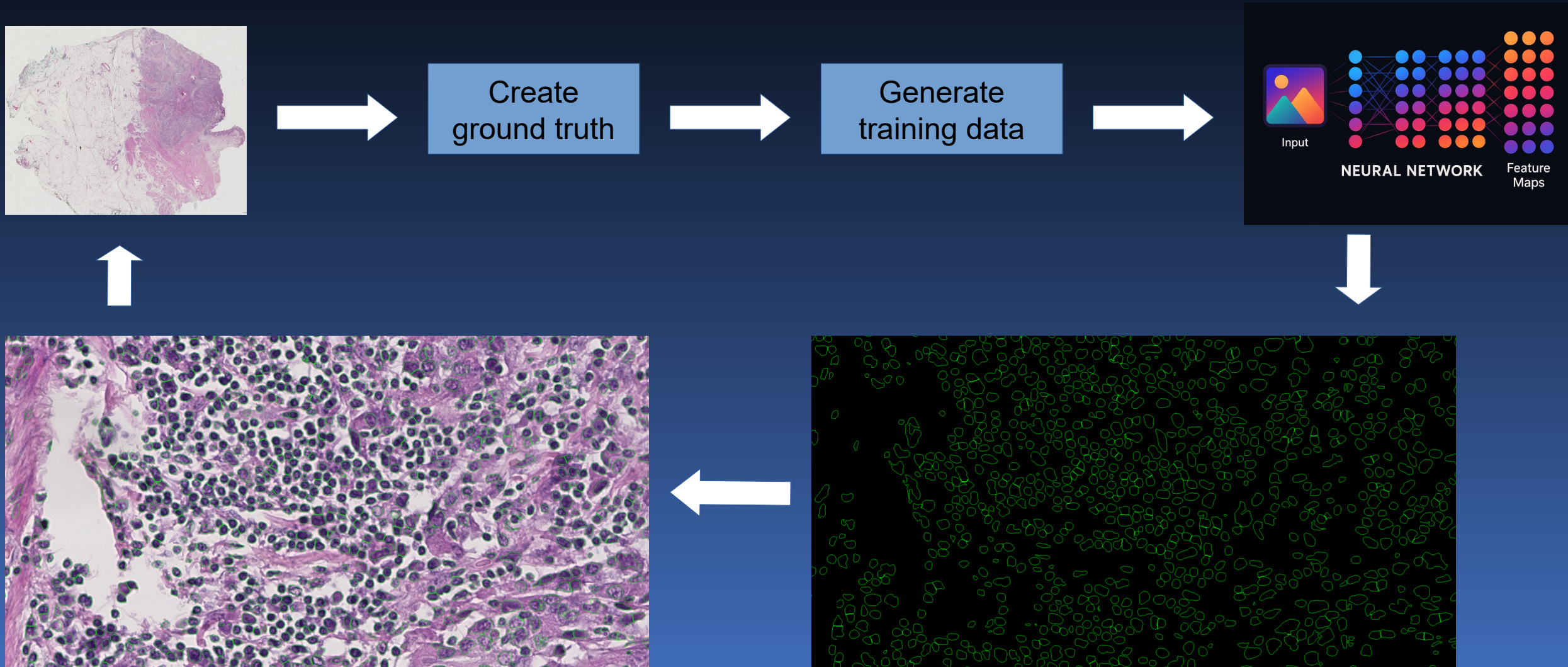
HD1080

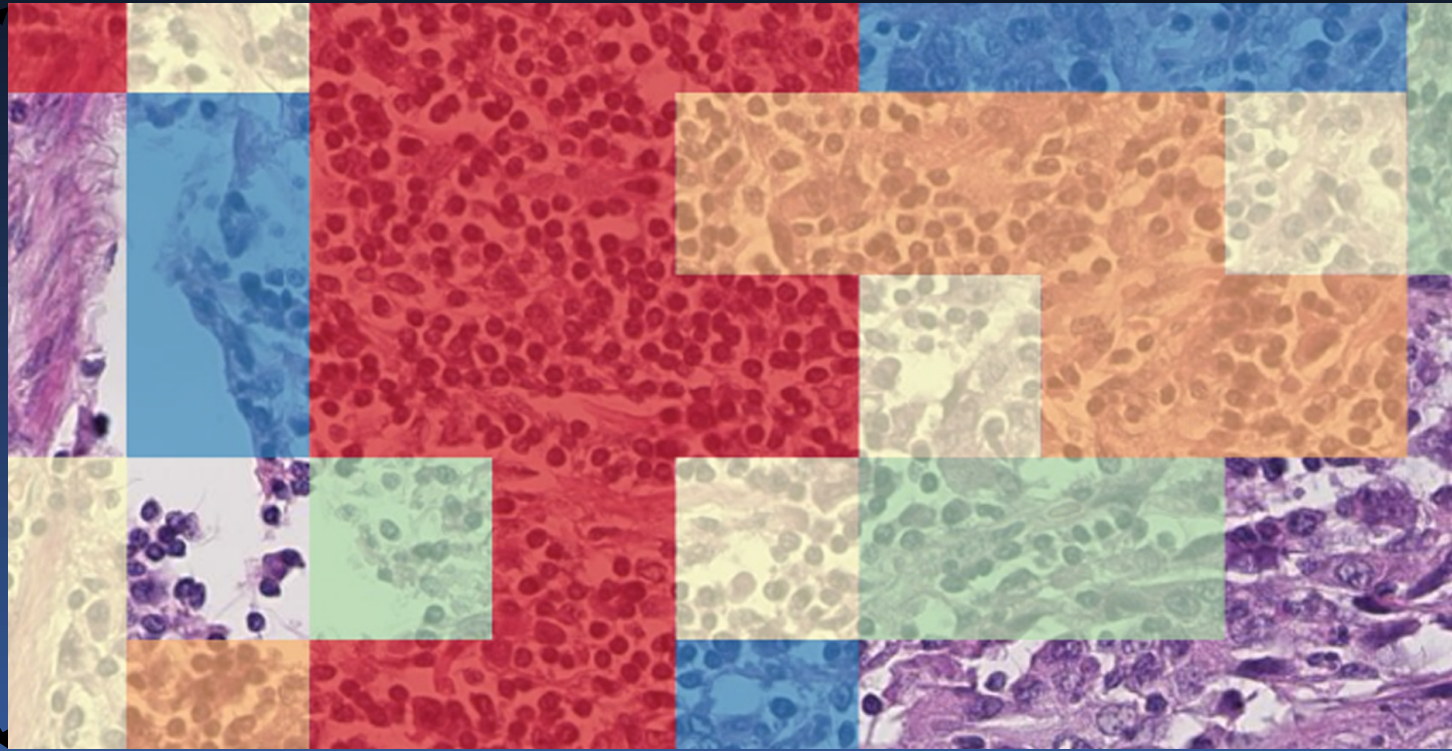
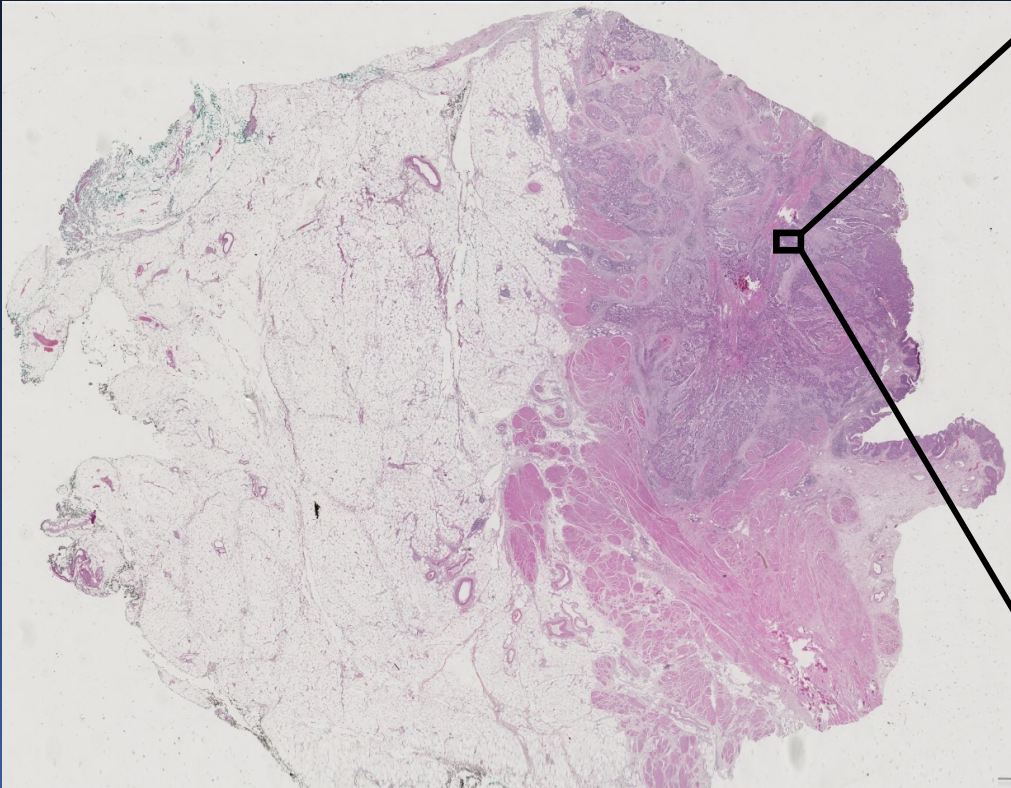
4K

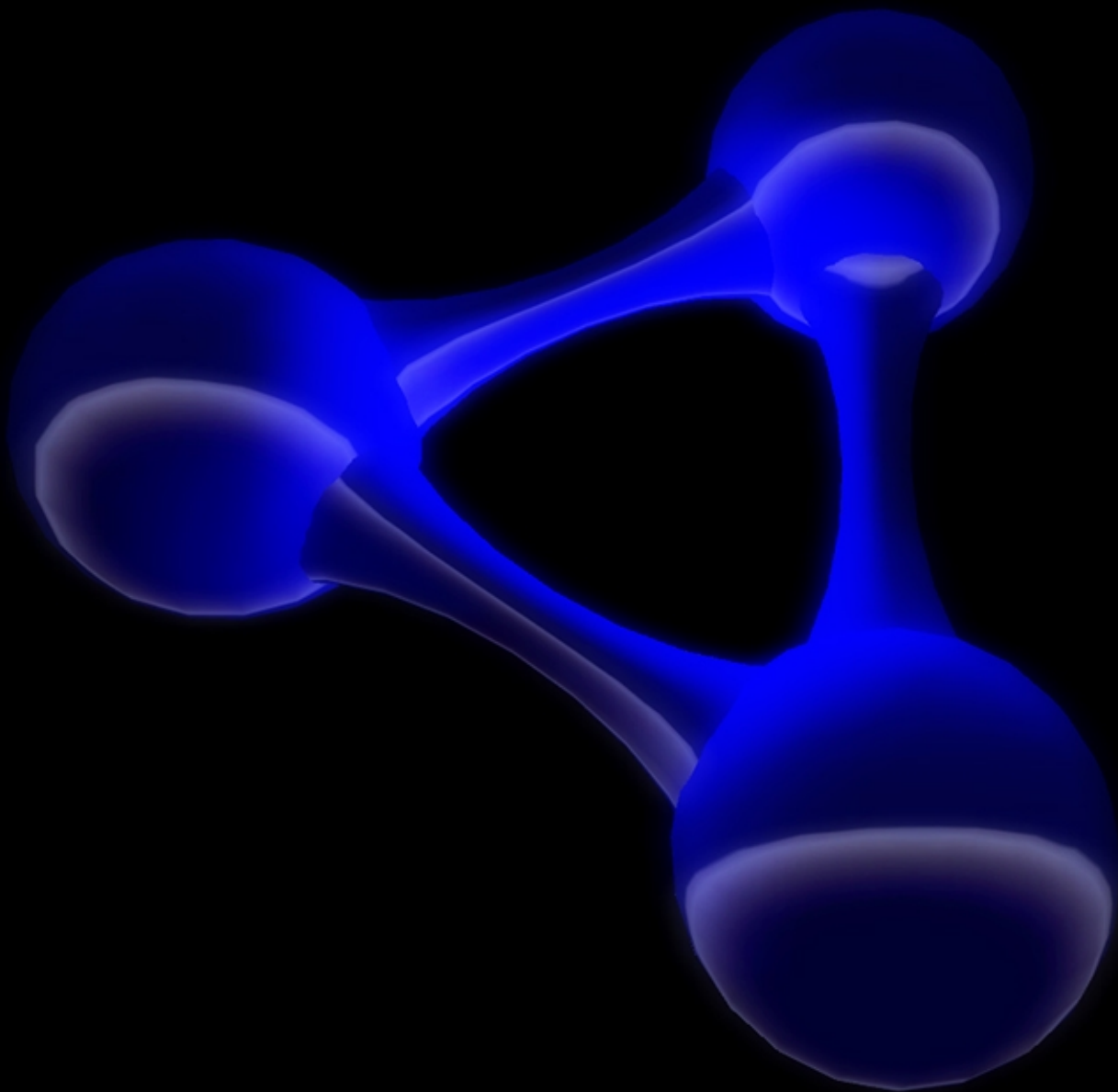
8K



Research Life Cycle of a Pathology Image



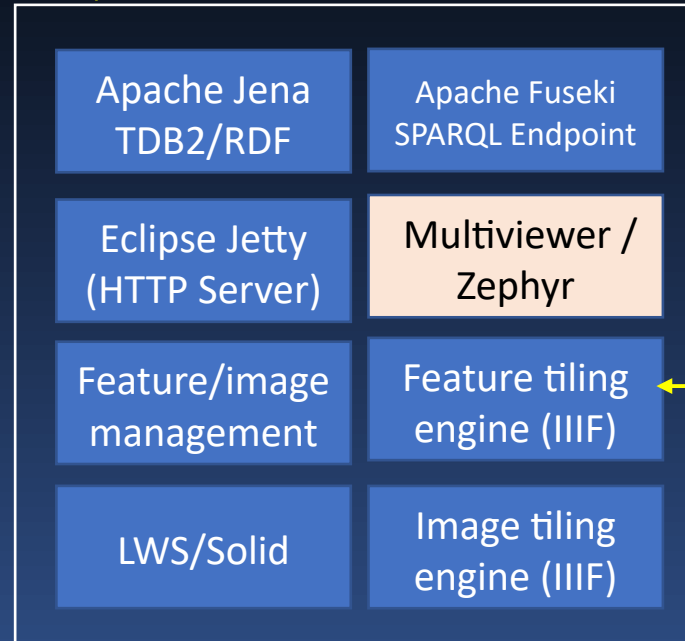




How to ^{re}build this?



Halcyon



← SPARQL too!

Keycloak

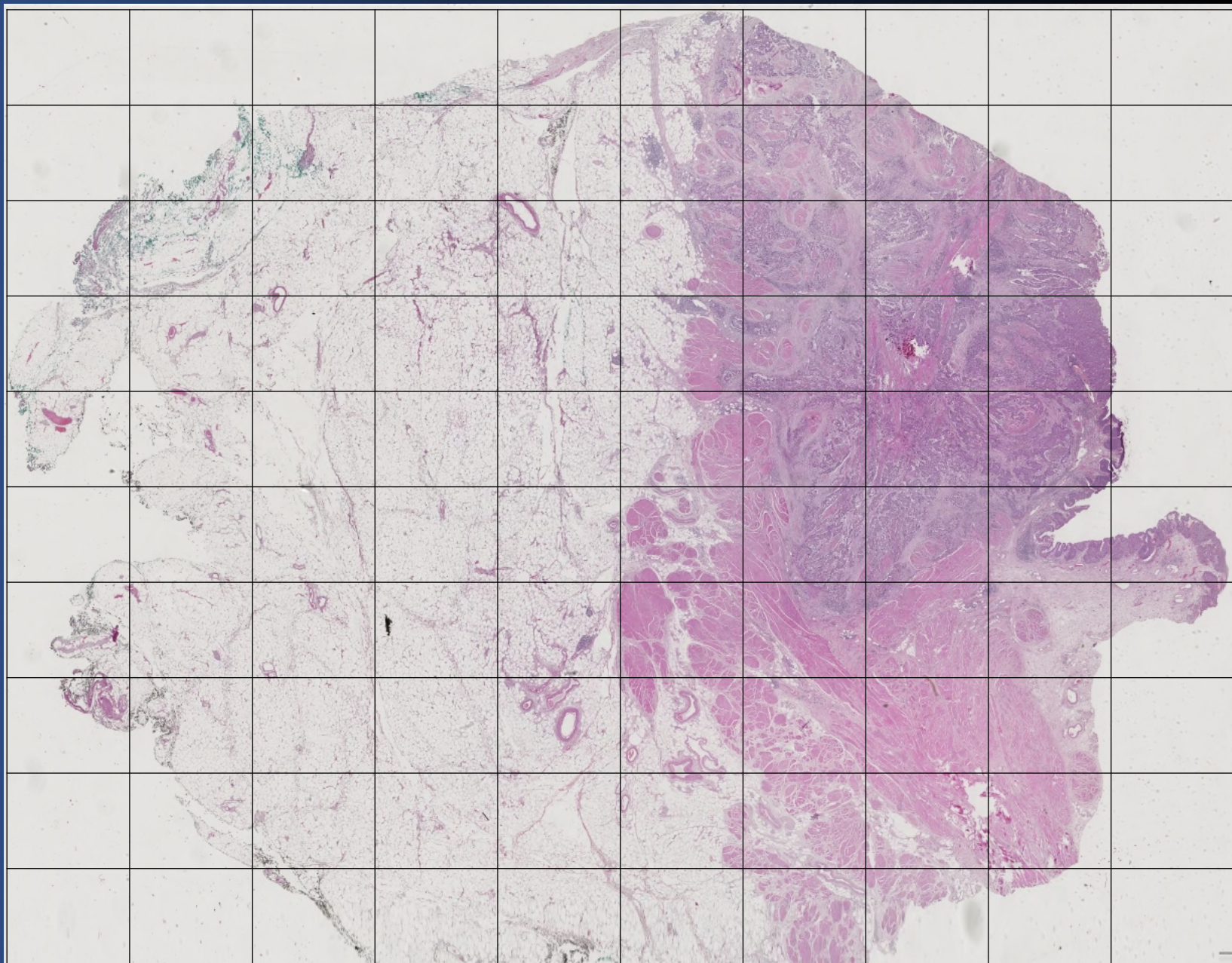
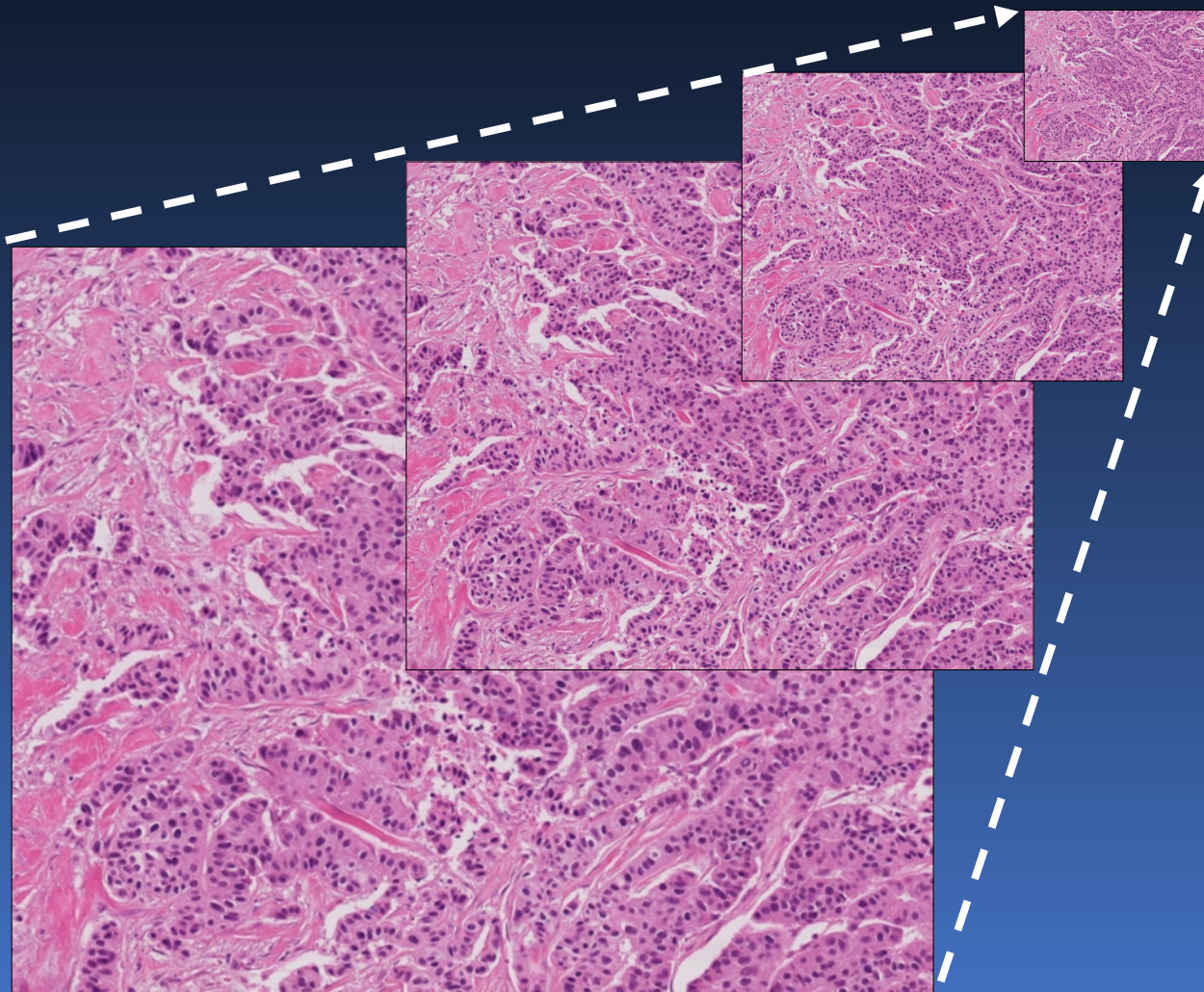


Image Pyramids



2,000 x 1,000

4,000 x 2,000

8,000 x 4,000

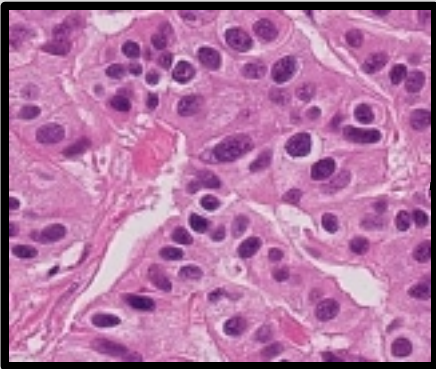
16,000 x 8,000

HTTP Range Requests

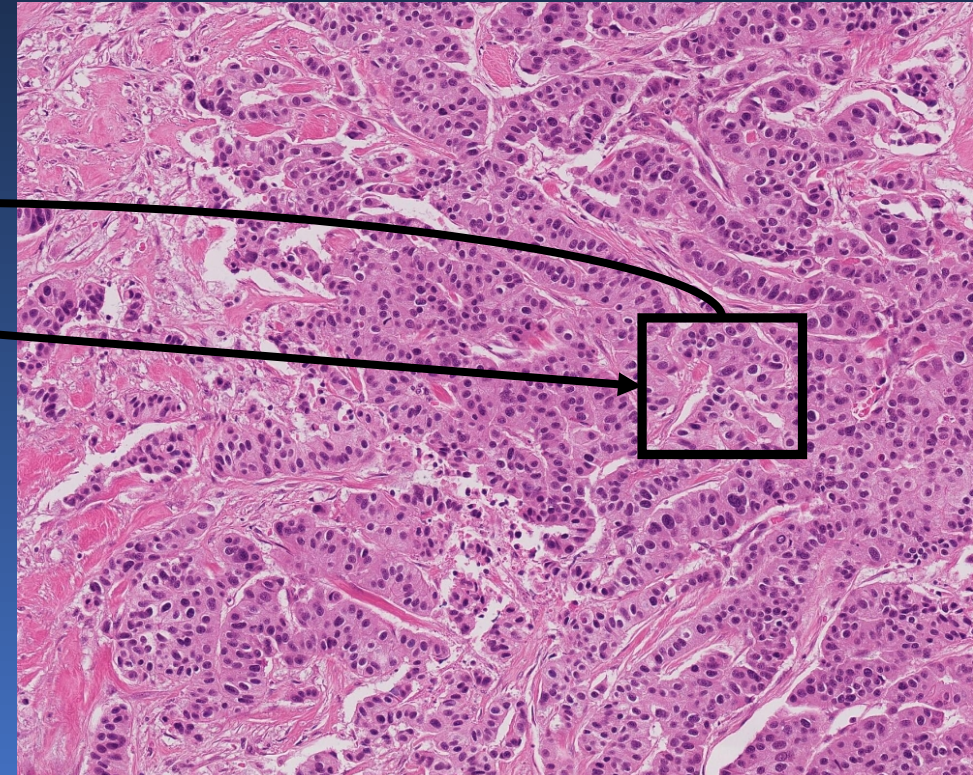
<https://pubmed.ncbi.nlm.nih.gov/28269829/>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7605284/>

Stony Brook Halcyon Instance



Amazon S3 Storage



HTTP Range Request
bytes=2345-3288

Polygon Representations



JSON (JavaScript Object Notation)

```
{
  "coordinates": [
    [
      [-72.2879255, 42.9214234],
      [-72.288065, 42.9210306],
      [-72.2875929, 42.9207399],
      [-72.2873461, 42.9209756],
      [-72.2871423, 42.920897],
      [-72.2870457, 42.9206928],
      [-72.2866166, 42.9208813],
      [-72.2864234, 42.9211485],
      [-72.2865415, 42.9213449],
      [-72.2864556, 42.9214549],
      [-72.2867239, 42.921667],
      [-72.2869492, 42.921777],
      [-72.287432, 42.9217456],
      [-72.2878182, 42.9216749],
      [-72.2879148, 42.9214313]
    ]
  ],
  "type": "Polygon"
}
```

Well-known text representation (WKT)

```
POLYGON (
  72.2879255 42.9214234,
  -72.288065 42.9210306,
  -72.2875929 42.9207399,
  -72.2873461 42.9209756,
  -72.2871423 42.920897,
  -72.2870457 42.9206928,
  -72.2866166 42.9208813,
  -72.2864234 42.9211485,
  -72.2865415 42.9213449,
  -72.2864556 42.9214549,
  -72.2867239 42.921667,
  -72.2869492 42.921777,
  -72.287432 42.9217456,
  -72.2878182 42.9216749,
  -72.2879148 42.9214313
)
```

Scalable Vector Graphics (SVG)

```
<svg>
  <polygon points="-72.2879255, 42.9214234
    -72.288065, 42.9210306
    -72.2875929, 42.9207399
    -72.2873461, 42.9209756
    -72.2871423, 42.920897
    -72.2870457, 42.9206928
    -72.2866166, 42.9208813
    -72.2864234, 42.9211485
    -72.2865415, 42.9213449
    -72.2864556, 42.9214549
    -72.2867239, 42.921667
    -72.2869492, 42.921777
    -72.287432, 42.9217456
    -72.2878182, 42.9216749
    -72.2879148, 42.9214313"
    style="fill:lime;stroke:purple;stroke-width:1"
  />
</svg>
```

Spatial Indexing Methods

Geohash

HHCode

Z-order curve

Quadtree

Octree

UB-tree

R-tree

R+ tree

R* tree

Hilbert R-tree

X-tree

kd-tree

m-tree

Binary space partitioning (BSP-Tree)



Hilbert Curve

A Hilbert curve (also known as a Hilbert space-filling curve) is a continuous fractal space-filling curve first described by the German mathematician David Hilbert in 1891 - Wikipedia

0	3	4	5	58	59	60	63	64	65	78	79	80	83	84	85	938	939	940	943	944	945	958	959	960	963	964	965	1018	1019	1020	1021	1022
1	2	7	6	57	56	61	62	67	66	77	76	81	82	87	86	937	936	941	942	947	946	957	956	961	962	967	966	1017	1016	1021	1022	
14	13	8	9	54	55	50	49	68	71	72	75	94	93	88	89	934	935	930	929	948	951	952	955	974	973	968	969	1014	1015	1010	1009	
15	12	11	10	53	52	51	48	69	70	73	74	95	92	91	90	933	932	931	928	949	950	953	954	975	972	971	970	1013	1012	1011	1008	
16	17	30	31	32	33	46	47	122	121	118	117	96	99	100	101	922	923	924	927	906	905	902	901	976	977	990	991	992	993	1006	1007	
19	18	29	28	35	34	45	44	123	120	119	116	97	98	103	102	921	920	925	926	907	904	903	900	979	978	989	988	995	994	1005	1004	
20	23	24	27	36	39	40	43	124	125	114	115	110	109	104	105	918	919	914	913	908	909	898	899	980	983	984	987	996	999	1000	1003	
21	22	25	26	37	38	41	42	127	126	113	112	111	108	107	106	917	916	915	912	911	910	897	896	981	982	985	986	997	998	1001	1002	
234	233	230	229	218	217	214	213	128	129	142	143	144	147	148	149	874	875	876	879	880	881	894	895	810	809	806	805	794	793	790	789	
235	232	231	228	219	216	215	212	131	130	141	140	145	146	151	150	873	872	877	878	883	882	893	892	811	808	807	804	795	792	791	788	
236	237	226	227	220	221	210	211	132	135	136	139	158	157	152	153	870	871	866	865	884	887	888	891	812	813	802	803	796	797	786	787	
239	238	225	224	223	222	209	208	133	134	137	138	159	156	155	154	869	868	867	864	885	886	889	890	815	814	801	800	799	798	785	784	
240	243	244	245	202	203	204	207	186	185	182	181	160	163	164	165	858	859	860	863	842	841	838	837	816	819	820	821	778	779	780	783	
241	242	247	246	201	200	205	206	187	184	183	180	161	162	167	166	857	856	861	862	843	840	839	836	817	818	823	822	777	776	781	782	
254	253	248	249	198	199	194	193	188	189	178	179	174	173	168	169	854	855	850	849	844	845	834	835	830	829	824	825	774	775	770	769	
255	252	251	250	197	196	195	192	191	190	177	176	175	172	171	170	853	852	851	848	847	846	833	832	831	828	827	826	773	772	771	768	
256	257	270	271	272	275	276	277	490	491	492	495	496	497	510	511	512	513	526	527	528	531	532	533	746	747	748	751	752	753	766	767	
259	258	269	268	273	274	279	278	489	488	493	494	499	498	509	508	515	514	525	524	529	530	535	534	745	744	749	750	755	754	765	764	
260	263	264	267	286	285	280	281	486	487	482	481	500	503	504	507	516	519	520	523	542	541	536	537	742	743	738	737	756	759	760	763	
261	262	265	266	287	284	283	282	485	484	483	480	501	502	505	506	517	518	521	522	543	540	539	538	741	740	739	736	757	758	761	762	
314	313	310	309	288	291	292	293	474	475	476	479	458	457	454	453	570	569	566	565	544	547	548	549	730	731	732	735	714	713	710	709	
315	312	311	308	289	290	295	294	473	472	477	478	459	456	455	452	571	568	567	564	545	546	551	550	729	728	733	734	715	712	711	708	
316	317	306	307	302	301	296	297	470	471	466	465	460	461	450	451	572	573	562	563	558	557	552	553	726	727	722	721	716	717	706	707	
319	318	305	304	303	300	299	298	469	468	467	464	463	462	449	448	575	574	561	560	559	556	555	554	725	724	723	720	719	718	705	704	
320	323	324	325	378	379	380	383	384	387	388	389	442	443	444	447	576	579	580	581	634	635	636	639	640	643	644	645	698	699	700	703	
321	322	327	326	377	376	381	382	385	386	391	390	441	440	445	446	577	578	583	582	633	632	637	638	641	642	647	646	697	696	701	702	
334	333	328	329	374	375	370	369	398	397	392	393	438	439	434	433	590	589	584	585	630	631	626	625	654	653	648	649	694	695	690	689	
335	332	331	330	373	372	371	368	399	396	395	394	437	436	435	432	591	588	587	586	629	628	627	624	655	652	651	650	693	692	691	688	
336	337	350	351	352	353	366	367	400	401	414	415	416	417	430	431	592	593	606	607	608	609	622	623	656	657	670	671	672	673	686	687	
339	338	349	348	355	354	365	364	403	402	413	412	419	418	429	428	595	594	605	604	611	610	621	620	659	658	669	668	675	674	685	684	
340	343	344	347	356	359	360	363	404	407	408	411	420	423	424	427	596	599	600	603	612	615	616	619	660	663	664	667	676	679	680	683	
341	342	345	346	357	358	361	362	405	406	409	410	421	422	425	426	597	598	601	602	613	614	617	618	661	662	665	666	677	678	681	682	

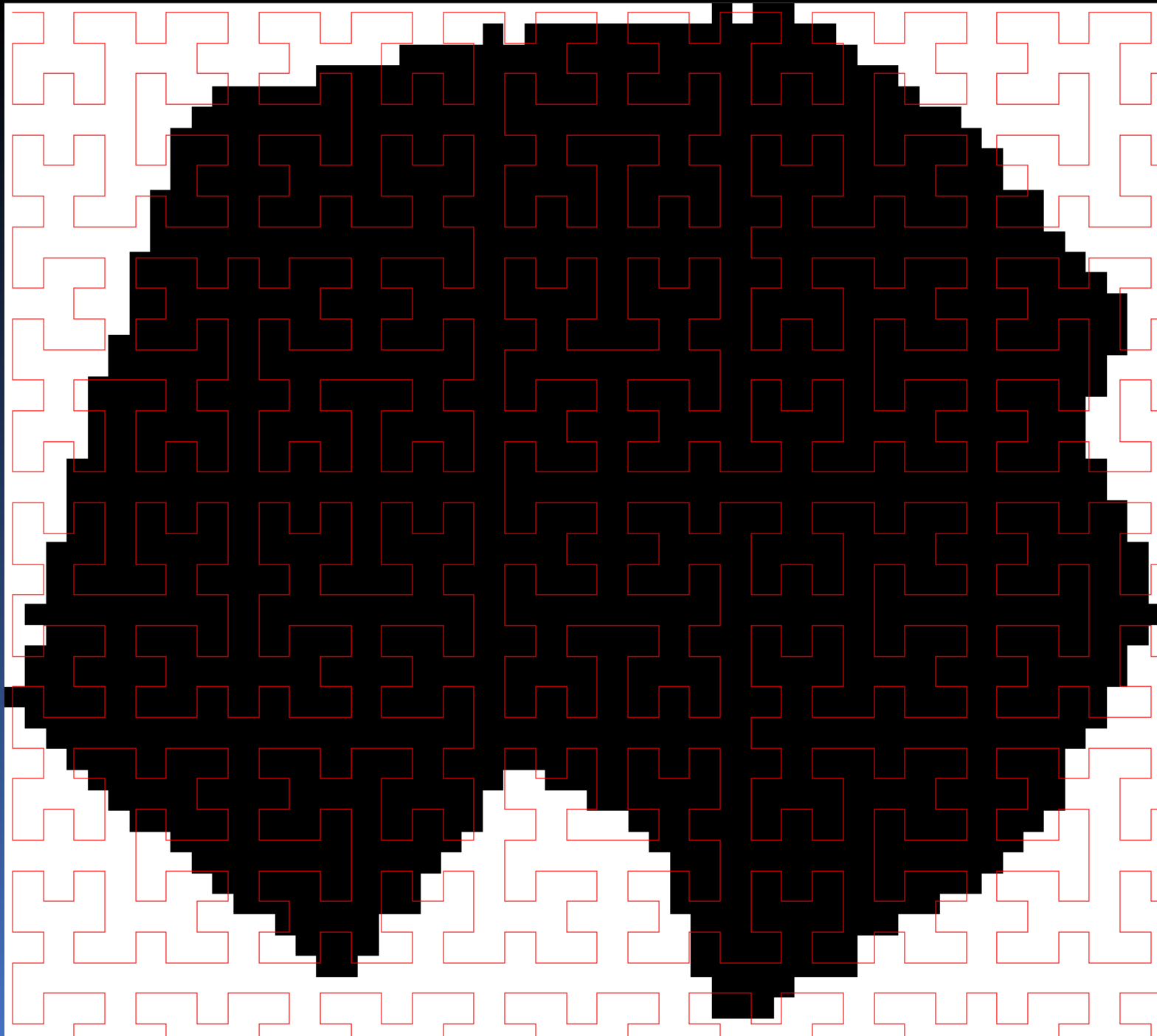
Hilbert Equations Simplified

$$N = H(X,Y)$$

$$(X,Y) = H^{-1}(N)$$

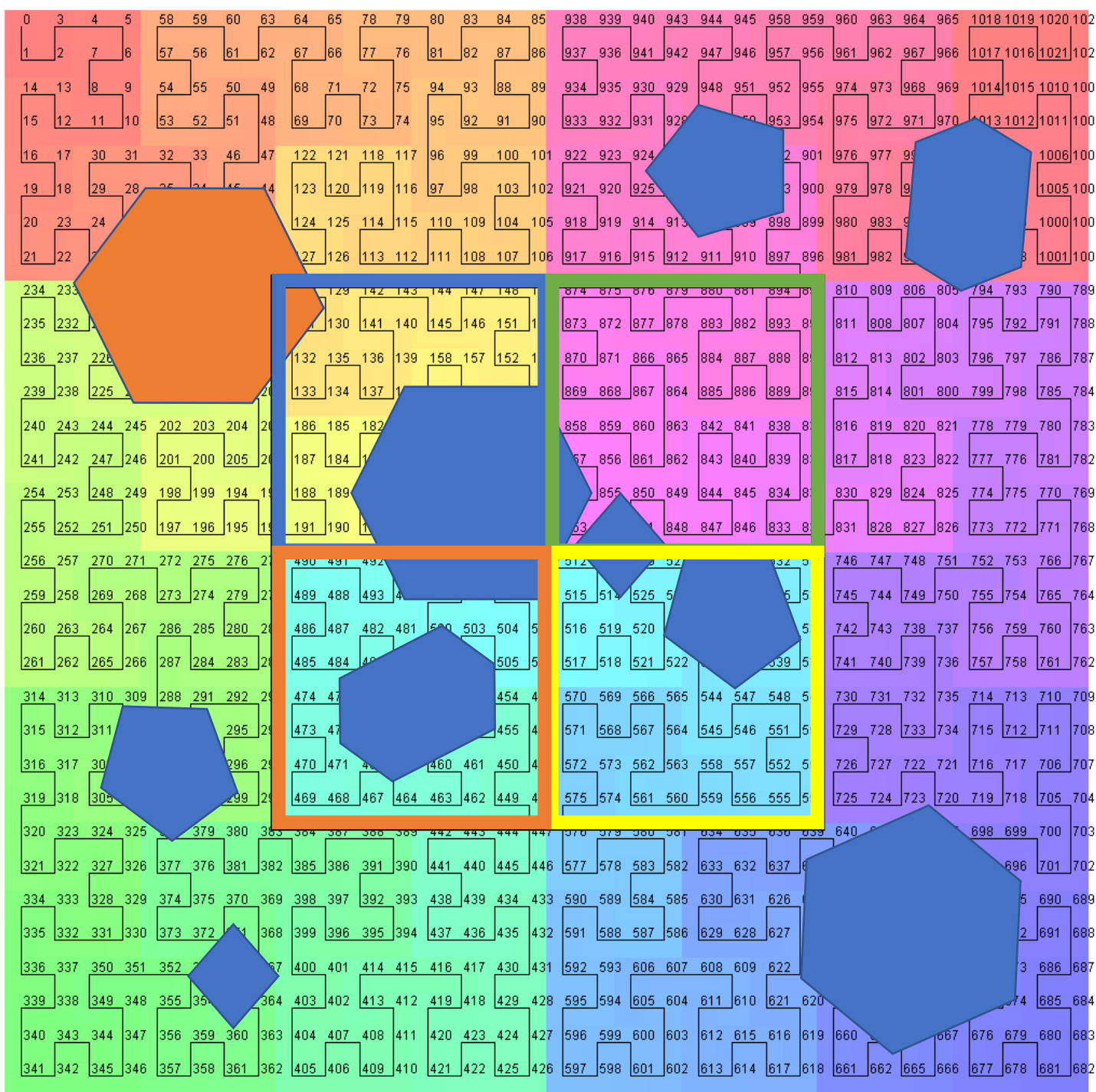
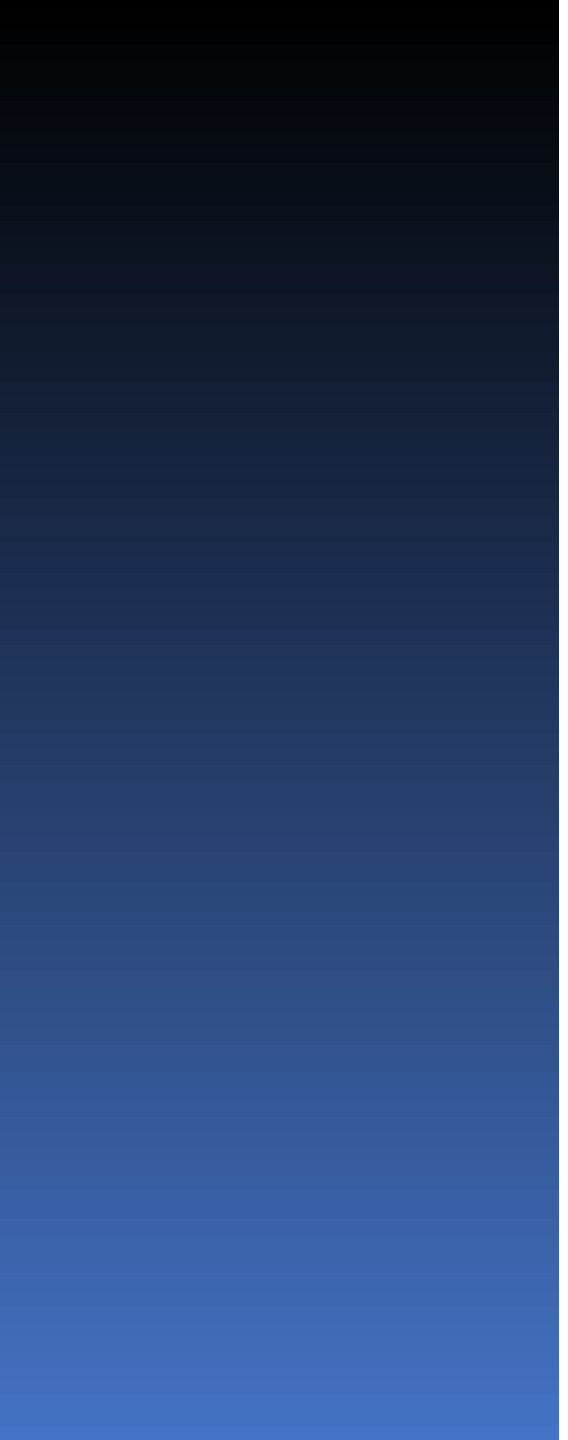
Spatial Locality

Any two points that are close to each other on the Hilbert Index are close to each other in cartesian space.

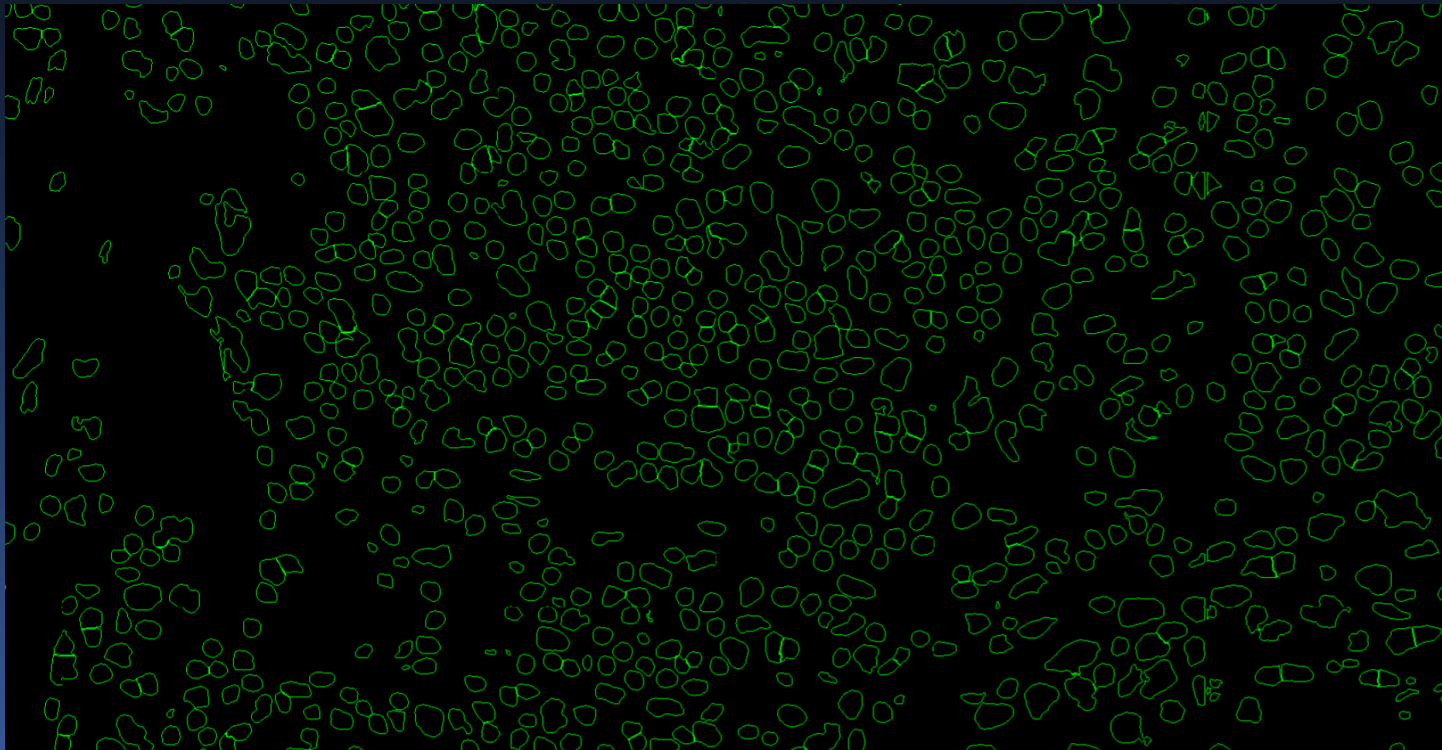


Hilbert Polygon Representation

```
{  
  "name": "Polygon 1",  
  "type": "Nuclear Material",  
  "ranges": [  
    [45,89],  
    [93,105],  
    [109,145],  
    [203,204],  
    [210,304],  
    [310,332],  
    [342,400]  
  ]  
}
```



Nuclear segmentation Case



135,168 x 105,472 pixels

of polygons = 1,547,170

of points = 54,600,980

35.3 (X,Y) points per polygon

of Hilbert ranges = 36,478,264

23.6 (N) Hilbert Ranges per polygon

<https://arxiv.org/abs/2005.06469>

GeoSPARQL



Installing

Image Annotation Toolbar

Annotations

Building

Authorization

About

```
@prefix dc: <http://purl.org/dc/terms/> .
@prefix exif: <http://www.w3.org/2003/12/exif/ns#> .
@prefix geo: <http://www.opengis.net/ont/geosparql#> .
@prefix hal: <https://halcyon.is/ns/> .
@prefix prov: <http://www.w3.org/ns/prov#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix sno: <http://snomed.info/id/> .
@prefix so: <https://schema.org/> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
```

```
<urn:md5:a923c8367e61792f531e65d966d4cb78>
  a so:ImageObject;
  exif:height "82984"^^xsd:int;
  exif:width "112231"^^xsd:int .
```

```
[ a geo:FeatureCollection;
```

```
  dc:creator "http://orcid.org/0000-0003-0223-1059";
  dc:date "2023-11-09T19:48:15.406625700Z"^^xsd:dateTime;
  dc:description "Nuclear segmentation of TCGA cancer types";
  dc:publisher <https://ror.org/01882y777> , <https://ror.org/05qghxh33>;
  dc:references "https://doi.org/10.1038/s41597-020-0528-1";
  dc:title "cnn-nuclear-segmentations-2019";
  prov:wasGeneratedBy [ a prov:Activity;
    prov:used <urn:md5:a923c8367e61792f531e65d966d4cb78>;
    prov:wasAssociatedWith <https://github.com/SBU-BMI/quip_cnn_segmentation/releases>;
  ];
```

```
  rdfs:member [ a geo:Feature;
    geo:hasGeometry [ geo:asWKT "POLYGON ((69379 61479, 69378 61480, 69373 61481, 69374 61482, 69379 61479))";
    hal:classification sno:48512009;
    hal:measurement [ hal:classification sno:48512009;
      hal:hasProbability "1.0"^^xsd:float;
    ]
  ];
```

```
  rdfs:member [ a geo:Feature;
    geo:hasGeometry [ geo:asWKT "POLYGON ((87135 28142, 87134 28143, 87133 28144, 87135 28142))";
    hal:classification sno:48512009;
    hal:measurement [ hal:classification sno:48512009;
      hal:hasProbability "1.0"^^xsd:float;
    ]
  ];
```

```
  rdfs:member [ a geo:Feature;
```



BeakGraph

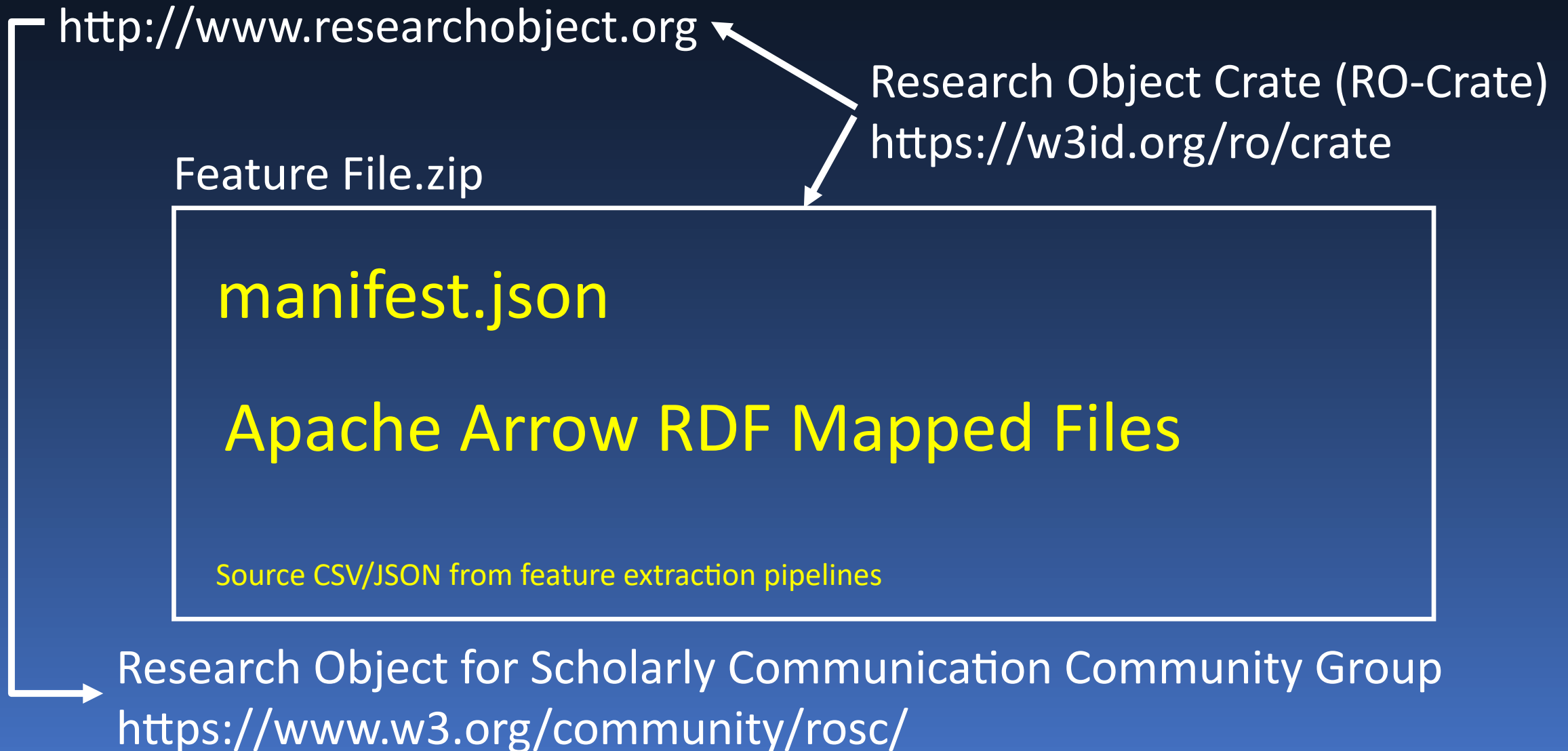


BeakGraph implements a full RDF Dataset complete with quads.

BeakGraph is a [Apache Jena](#) Graph implementation backed by [Apache Arrow](#) wrapped in a [Research Object Crate \(RO-Crate\)](#) inspired by [HDT](#).

Developed to power [Halcyon](#). See [Arxiv](#) paper at <http://arxiv.org/abs/2304.10612>

Halcyon Feature Storage





Beakgraph v2
HDT wrapped in a
HDF5 file

Later...
Zarr
Zip
DICOM
file directory
an actual HDT file?

HDFView 3.3.2

File Window Tools Help

Recent Files

D:\data\dX.h5

Clear Text

dX.h5

.HDT

BBo

BBp

BBs

SBo

SBp

SBs

dictionary

graphs

datatype

iri

offsets

stringbuffer

offsets

objects

datatype

doubles

floats

integers

iri

offsets

stringbuffer

longs

offsets

strings

offsets

stringbuffer

predicates

datatype

iri

offsets

stringbuffer

offsets

shared

datatype

iri

offsets

stringbuffer

offsets

subjects

datatype

offsets

Object Attribute Info

General Object Info

Attribute Creation Order:

Creation Order NOT Tracked

Number of attributes = 2

Name	Type	Array Size	Value[50](...)
numEntries	64-bit integer	Scalar	27
width	64-bit integer	Scalar	4

stringbuffer at ./HDT/dictionary/predicates/iri/ [dX.h5 in D:\data]

Table

Import/Export Data

Data Display

0-based

0	01101000
1	01110100
2	01110100
3	01110000
4	00111010
5	00101111
6	00101111
7	01110000
8	01110101
9	01110010
10	01101100
11	00101110
12	01101111
13	01110010
14	01100111
15	00101111
16	01100100
17	01100011
18	00101111
19	01110100
20	01100101
21	01110010
22	01101101
23	01110011
24	00101111
25	01100011
26	01110010
27	01100101

User property file - C:\Users\Erich Bremer\hdfview3.3.2

offsets at ./HDT/dictionary/objects/strings/ [dX.h5 in D:\data] [dims0, start0, count7502472, stride1]

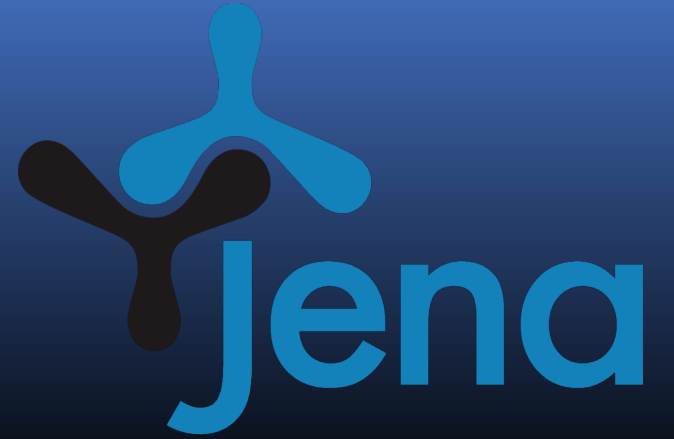
*** Error: unable to load table data ***

datatype at ./HDT/dictionary/predicates/ [dX.h5 in D:\data] [dims0, start0, count14, stride1]

stringbuffer at ./HDT/dictionary/predicates/iri/ [dX.h5 in D:\data] [dims0, start0, count633, stride1]



Halcyon
UI/UX



Vandegraph



HALCYON

Sign in to your account

Email

Password

Sign In

Collection :

Alpha

Filter

File URI	alias	Date Registered	width	height	Collection	Viewer
file:///D:/HalcyonStorage/upenn/TCGA-80-5608-01Z-00-DX1.CB85BA53-AF00-4C7D-8489-C2FF0F4F49AB.svs	urn:md5:0fc977067d714b8cbc571266b138bdd7	2022-04-07 15:12:05	21987	17849	urn:uuid:f1052bcd-7276-4d25-ac77-b24ce81599ca	select
file:///D:/HalcyonStorage/upenn/TCGA-AO-A0JC-01Z-00-DX1.C8DD421B-9799-4FE7-9224-5EAC6ED1028E.svs	urn:md5:6acdb49b58fc57c2041e2e84edcd5d03	2022-04-07 15:12:13	59759	37971	urn:uuid:f1052bcd-7276-4d25-ac77-b24ce81599ca	select
file:///D:/HalcyonStorage/demo1/TCGA-CM-5348-01Z-00-DX1.2ad0b8f6-684a-41a7-b568-26e97675cce9.svs	urn:md5:a923c8367e61792f531e65d966d4cb78	2022-04-07 15:12:48	112231	82984	urn:uuid:f1052bcd-7276-4d25-ac77-b24ce81599ca	select

Select Features for viewing

Selected	Create Action
☐ ☐	https://www.upenn.edu/PipeLine/Lymphocytes/site5
☐ ☐	https://www.upenn.edu/PipeLine/Lymphocytes/site6
☐ ☐	https://www.upenn.edu/PipeLine/Lymphocytes/site7
☐ ☐	https://www.upenn.edu/PipeLine/Lymphocytes/site8
☐ ☐	https://www.upenn.edu/PipeLine/Lymphocytes/Consensus
☐ ☐	https://www.upenn.edu/PipeLine/Lymphocytes/site1
☐ ☐	https://www.upenn.edu/PipeLine/Lymphocytes/site2
☐ ☐	https://www.upenn.edu/PipeLine/Lymphocytes/site3
☐ ☐	https://www.upenn.edu/PipeLine/Lymphocytes/site4
☐ ☐	https://www.upenn.edu/unknownpipeline
☐ ☐	https://bmi.stonybrook.edu/PipeLine/Combined/Dysplasia
☐ ☐	https://bmi.stonybrook.edu/PipeLine/Combined/Epithelium
☐ ☐	https://bmi.stonybrook.edu/PipeLine/Combined/Necrosis
☐ ☐	https://bmi.stonybrook.edu/PipeLine/Combined/Stroma
☐ ☐	https://bmi.stonybrook.edu/PipeLine/Combined/Tumor
☐ ☐	

Cancer Location

Prostate

Breast

Colon

Lung

Blood, Bone

Bone

Brain

Head-Neck

Ovary

Skin

Various

Blood

Chest

Esophagus

Head

Kidney

Lymph Node

Marrow

Marrow, Blood

Pancreas

Uterus

Various (11 locations)

0.0

0.5

1.0

1.5

2.0

2.5

3.0

3.5

4.0

4.5

5.0

Staining Protocol

Hematoxylin and eosin stain

N/A

Jenner-Giemsa stain

IHC stain, Hematoxylin and eosin stain, LCM

IHC, CODEX, Hematoxylin and eosin staining

May-Grunwald-Giemsa stain

Toluidine-eosin stain

0

2

4

6

8

10

12

14

16

18

20

22

24

26

28

30

Supporting Data

Clinical

Clinical, Genomics, Proteomics

Image Analyses

N/A

Clinical, Image Analyses

Image Analyses, Clinical, Genomics

0

2

4

6

8

10

12

14

16

Data Format

BMP

HDF5

TIFF

JPG

MRXS

NDPI

SVS

TIFF

0

2

4

6

8

10

12

14

16

18

20

22

24

26

28

Cancer Type

Prostate Cancer

Breast Cancer

Colorectal Cancer

Lung Cancer

Acute Myeloid Leukemia

Head and Neck Cancer

Multiple Myeloma

Ovarian Cancer

Adenocarcinoma

Clear Cell Carcinoma

Colon Cancer

Corpus Endometrial Carcinoma

Cutaneous Melanoma

Diffuse Large B-Cell Lymphoma

Ductal Adenocarcinoma

Gastroesophageal Cancer

Glioblastoma

Glioblastoma Multiforme

Glioma

HER2+ Breast Cancer

Leukemia

Leukemia & Lymphoma Cancers

Leukemia, Multiple Myeloma

Melanoma

Osteosarcoma

Sarcomas

Skin Cancer

Collection Data Table

CSV

PDF

Excel

Print

Search:

Collection	Visualize Data	Cancer Type	Location	Species	Data Format	Supporting Data	Protocol	Image Type	Pixel Aspect Ratio	Magnification	Size (GB)	Access	Updated
AML-Cytomorphology_LMU	View	Acute Myeloid Leukemia	Blood	Human	TIFF	Image Analyses	N/A	Photomicrograph	(0.290,0.290)mpp	100x	11	Public	2019-10-28
Bone-Marrow-Cytomorphology	View	Leukemia & Lymphoma Cancers	Marrow	Human	JPG	N/A	May-Grunwald-Giemsa stain	Photomicrograph	(0.086,0.086)mpp	40x	6.8	Public	2021-12-06
C-NMC 2019	View	Leukemia	Blood, Bone	Human	BMP	N/A	Jenner-Giemsa stain	Raster			10.44	Public	2019-05-28
CATCH	View	Skin Cancer	Skin	Canine	SVS	Image Analyses	Hematoxylin and eosin stain	Whole slide image	(0.253,0.253)mpp		522	Public	2022-01-13
CMB-CRC	View	Colorectal Cancer	Colon	Human	SVS	Clinical	Hematoxylin and eosin stain	Whole slide image	(0.252,0.252)mpp	40x	13.8	Public	2022-08-12
CMB-GEC	View	Gastroesophageal Cancer	Esophagus	Human	SVS	Clinical	Hematoxylin and eosin stain	Whole slide image	(0.252,0.252)mpp	40x	0.103	Saltz-Lab	2022-08-12
							Hematoxylin and						

Species

Human

Collection Access

Public

Halcyon

localhost:8888/sparql

HomeSecurityContainersImagesSPARQLUserHelpLogout

SPARQL Endpoint

Query

1

PREFIX

19

select

*

20

where

{graph ?g {?s ?p ?o}}

21

limit

200

200 results in 0.058 seconds

Simple viewEllipseFilter query resultsPage size: 50

s	p	o	g
1<https://localhost:8888/ldp/zarr/>	rdf:type	ldp:Container	hal:CollectionsAndResources
2<https://localhost:8888/ldp/zarr/>	rdf:type	ldp:BasicContainer	hal:CollectionsAndResources
3<https://localhost:8888/ldp/zarr/>	dct:title	zarr	hal:CollectionsAndResources
4<https://localhost:8888/ldp/zarr/>	ldp:contains	<https://localhost:8888/ldp/zarr/4495402.zarr/>	hal:CollectionsAndResources
5<https://localhost:8888/ldp/zarr/4495402.zarr/>	rdf:type	ldp:NonRDFSource	<https://localhost:8888/ldp/zarr/4495402.zarr/>
6<https://localhost:8888/ldp/zarr/4495402.zarr/>	rdf:type	so:ImageObject	<https://localhost:8888/ldp/zarr/4495402.zarr/>
7<https://localhost:8888/ldp/zarr/4495402.zarr/>	dct:title		<https://localhost:8888/ldp/zarr/4495402.zarr/>
8<https://localhost:8888/ldp/zarr/4495402.zarr/>	dct:modified	"2024-12-05 16:50:06"	<https://localhost:8888/ldp/zarr/4495402.zarr/>
9<https://localhost:8888/ldp/zarr/4495402.zarr/>	hal:fileLastModified	"1733351170470"	<https://localhost:8888/ldp/zarr/4495402.zarr/>
10<https://localhost:8888/ldp/zarr/4495402.zarr/>	hal:validFile	"true"	<https://localhost:8888/ldp/zarr/4495402.zarr/>
11<https://localhost:8888/ldp/zarr/4495402.zarr/>	exif:width	"921600"	<https://localhost:8888/ldp/zarr/4495402.zarr/>

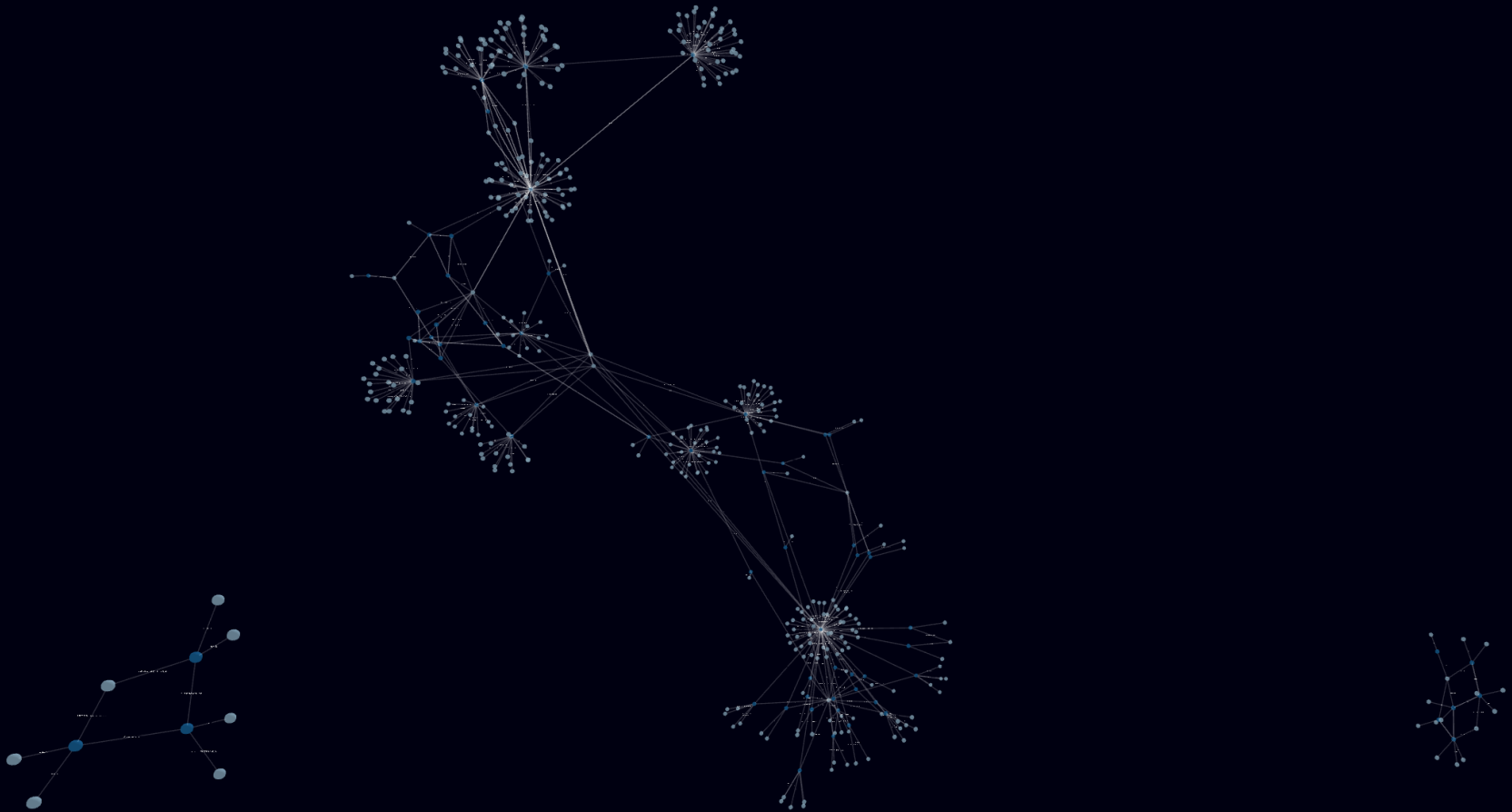
Update

Showing 106 to 140 of 142

<< < 1 2 3 4 5 > >>

[Predicate](#)

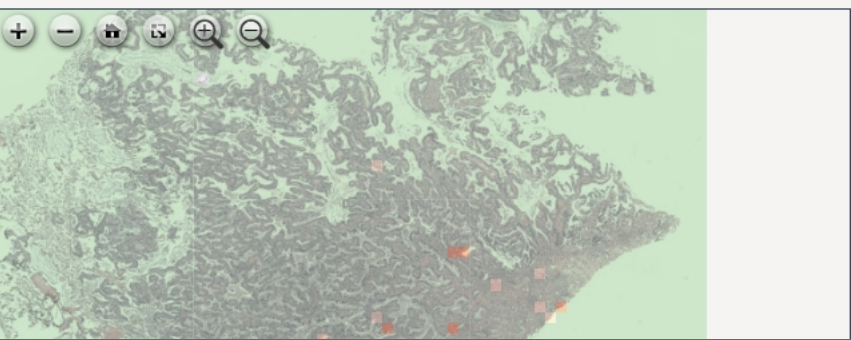
- ☒ <http://www.w3.org/2003/12/exif/ns#xyResolution>
- ☒ <http://www.w3.org/ns/auth/ac#accessTo>
- ☒ <http://www.w3.org/ns/auth/ac#agent>
- ☒ <http://www.w3.org/ns/auth/ac#mode>
- ☒ <http://www.w3.org/ns/prov#used>
- ☒ <http://www.w3.org/ns/prov#wasAssociatedWith>
- ☒ <http://www.w3.org/ns/prov#wasGeneratedBy>
- ☒ <https://halcyon.is/ns/color>
- ☒ <https://halcyon.is/ns/fileLastModified>
- ☒ <https://halcyon.is/ns/filemetaversion>
- ☒ <https://halcyon.is/ns/halcyonVersion>
- ☒ <https://halcyon.is/ns/hasAnnotationClass>
- ☒ <https://halcyon.is/ns/hasClass>
- ☒ <https://halcyon.is/ns/hasClassification>
- ☒ <https://halcyon.is/ns/tileSizeX>
- ☒ <https://halcyon.is/ns/tileSizeY>
- ☒ <https://halcyon.is/ns/validFile>
- ☒ <https://id.loc.gov/vocabulary/preservation/cryptographicHashFunctions/md5>
- ☒ <https://id.loc.gov/vocabulary/preservation/cryptographicHashFunctions/sha256>
- ☒ <https://schema.org/ScholarlyArticle>
- ☒ <https://schema.org/contentSize>
- ☒ <https://schema.org/creator>
- ☒ <https://schema.org/datePosted>
- ☒ <https://schema.org/datePublished>
- ☒ <https://schema.org/description>
- ☒ <https://schema.org/email>
- ☒ <https://schema.org/familyName>
- ☒ <https://schema.org/fileFormat>
- ☒ <https://schema.org/givenName>
- ☒ <https://schema.org/hasPart>
- ☒ <https://schema.org/instrument>
- ☒ <https://schema.org/isPartOf>
- ☒ <https://schema.org/member>
- ☒ <https://schema.org/memberOf>
- ☒ <https://schema.org/name>



☒ Match Pan ☒ Match Zoom

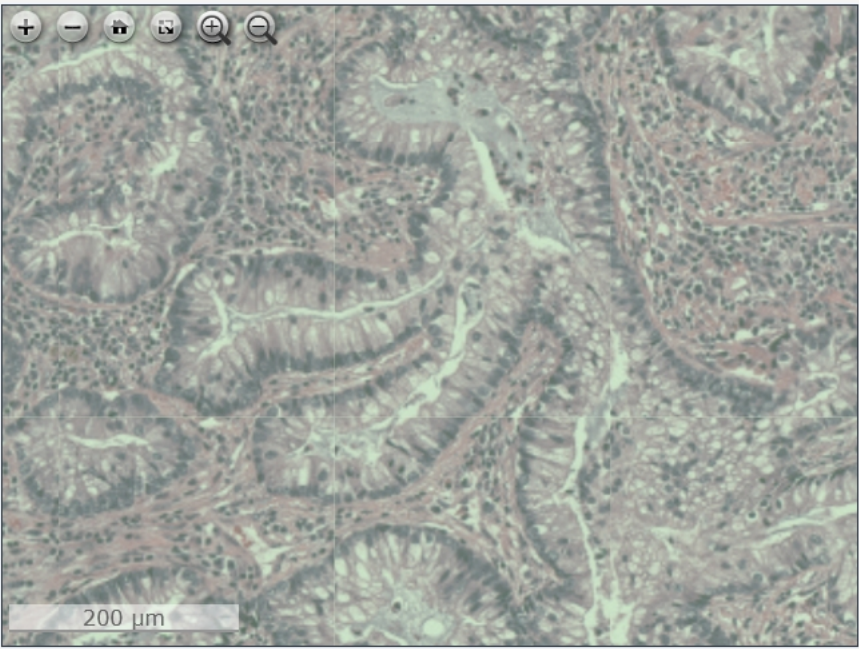


☒ Match Pan ☒ Match Zoom



☒ Match Pan ☐ Match Zoom

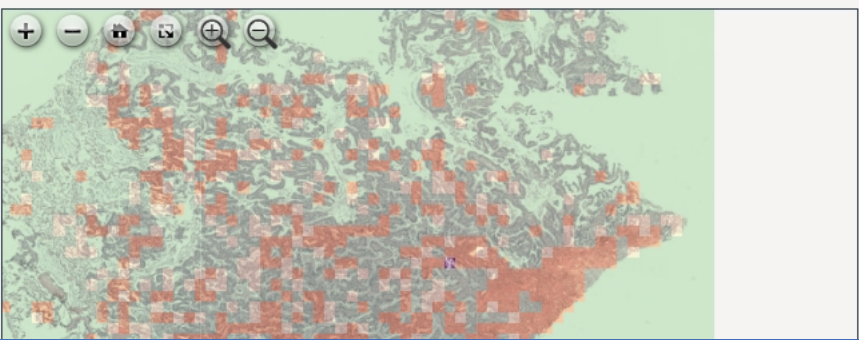
TCG...
site5



☒ Match Pan ☒ Match Zoom

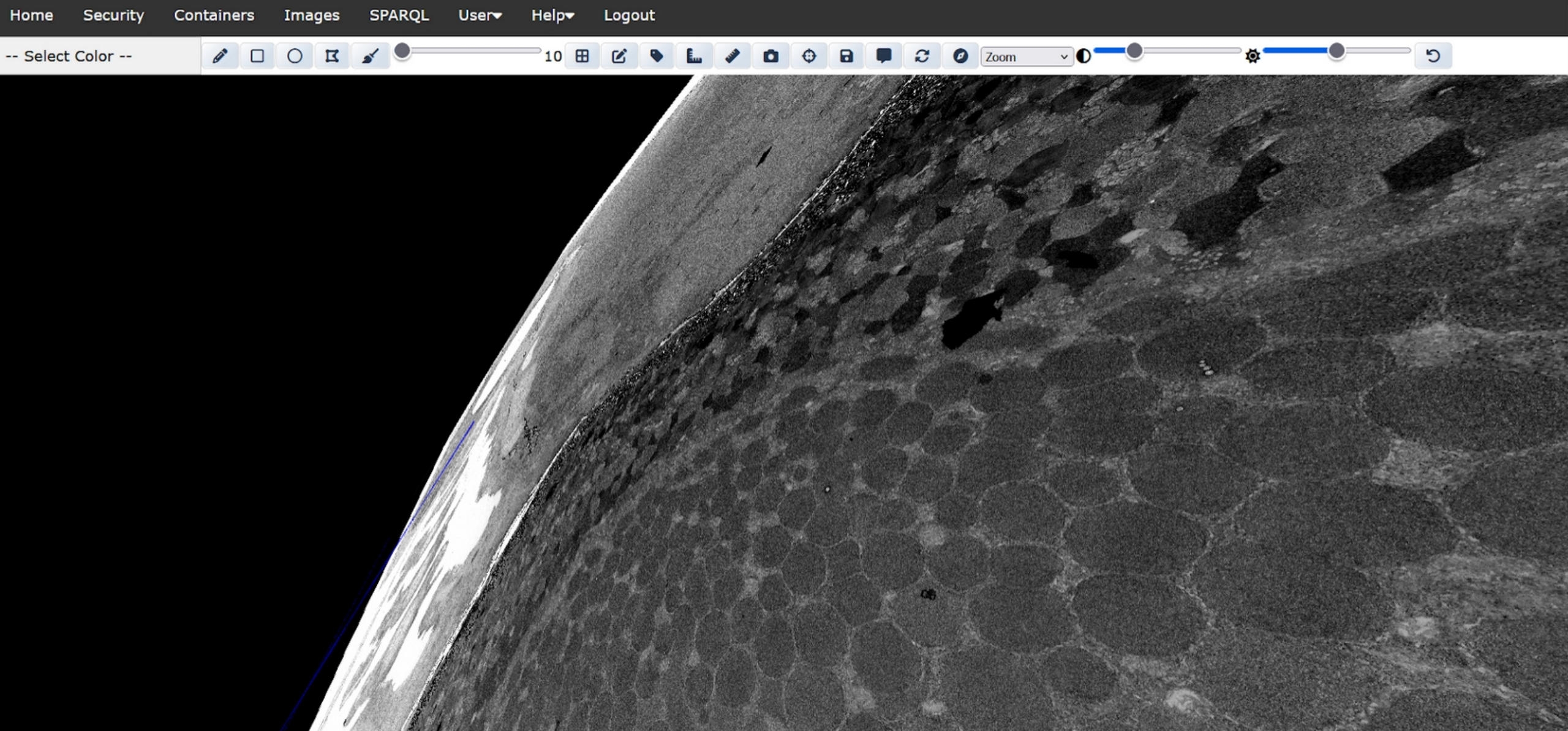
TCG...
site6

TCG...
site7



TCG...
site8

Zephyr – A new WebGL Image Viewer with annotation tools



Halcyon

localhost:8888/zephyrx277

HomeSecurityContainersImagesSPARQLUser▼Help▼Logout

Lymphocyte (cell)

Liver structure (body structure)

Heart structure (body structure)

Liver pate (substance)

Brain structure (body structure)

Stizostedion vitreum vitreum (organism)

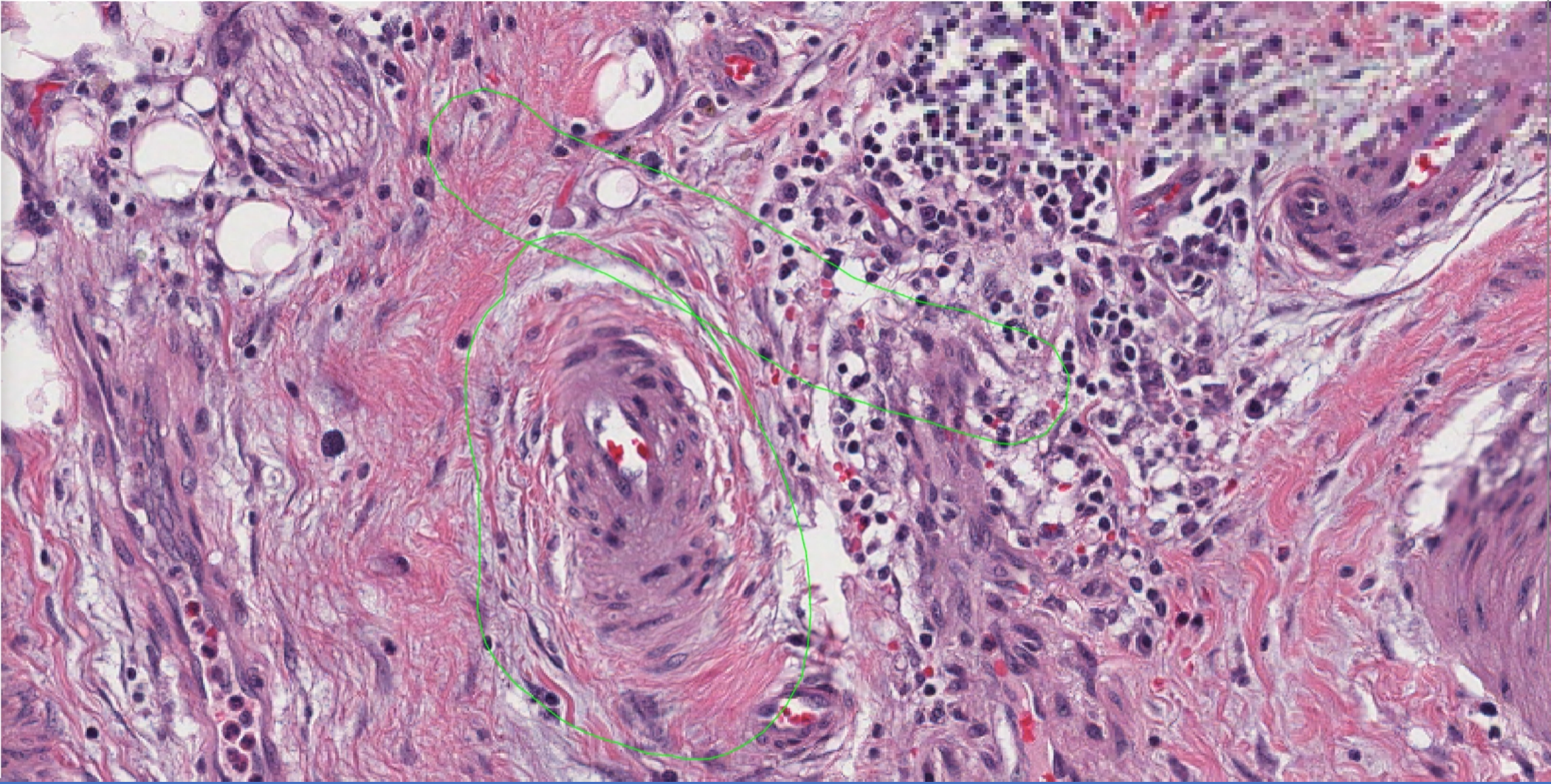
Golgi complex (cell structure)

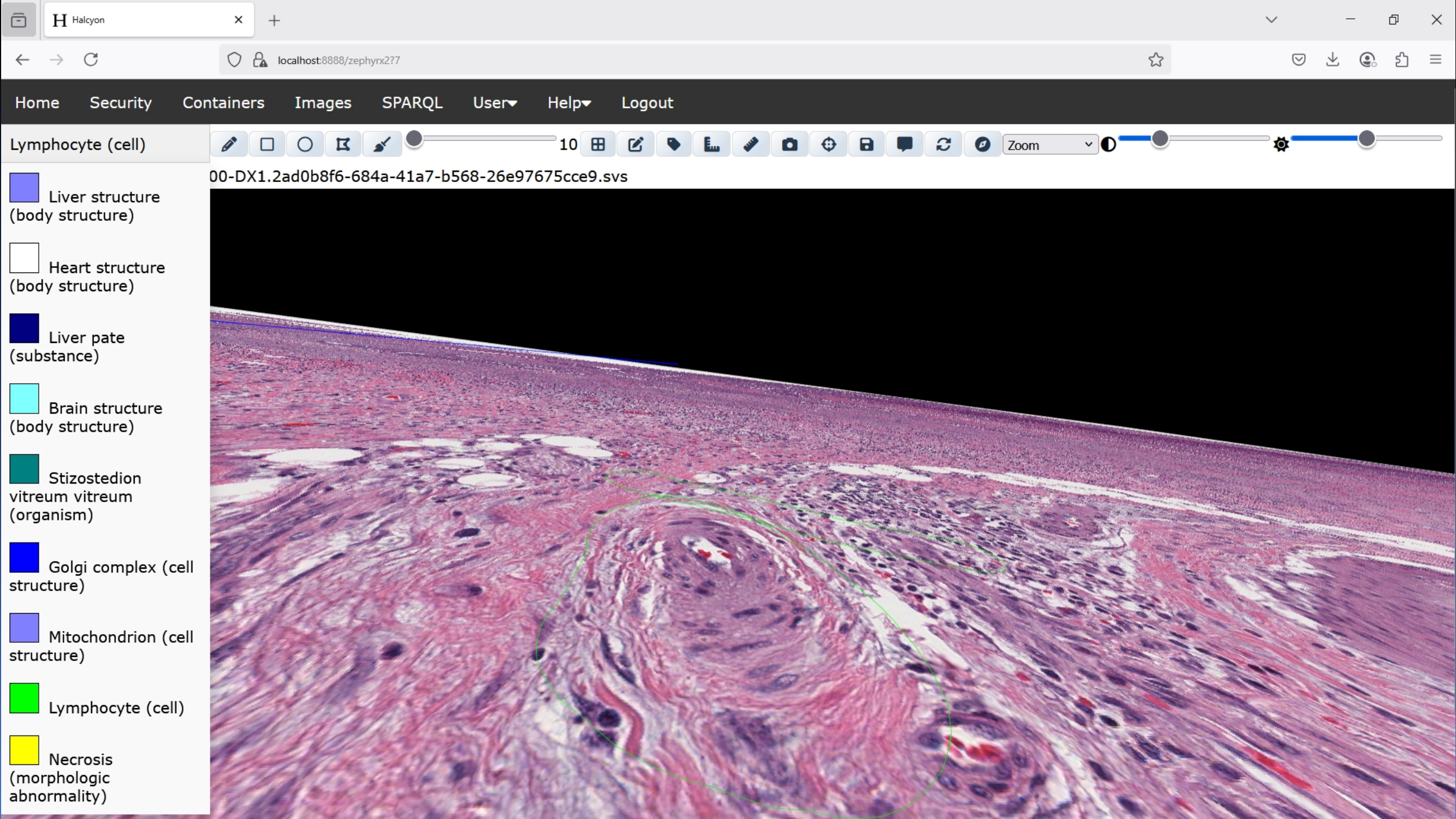
Mitochondrion (cell structure)

Lymphocyte (cell)

Necrosis (morphologic abnormality)

00-DX1.2ad0b8f6-684a-41a7-b568-26e97675cce9.svs

A histological image showing a cross-section of tissue. A green outline highlights a specific region in the center-left of the image, which appears to be a glandular or ductal structure. The surrounding tissue is stained with hematoxylin and eosin (H&E), showing various cellular structures and connective tissue. The image is displayed in a web browser window with a navigation bar and a legend on the left.



H Halcyon

localhost:8888/user/colorclasses?8

HomeSecurityContainersImagesSPARQLUserHelpLogout

SaveDeleteReset

Choose One

name

Raj's fav color classes

delete

Showing 1 to 5 of 9

<< < 1 2 > >>

Class	Color
Liver structure (body structure) <http://snomed.info/id/10200004>	delete
Brain structure (body structure) <http://snomed.info/id/12738006>	delete
Liver pate (substance) <http://snomed.info/id/227014008>	delete
Lymphocyte (cell) <http://snomed.info/id/56972008>	delete
Heart structure (body structure) <http://snomed.info/id/80891009>	delete

Halcyon

localhost:8888/user/colorclasses?8

HomeSecurityContainersImagesSPARQLUserHelpLogout

SaveDeleteReset

Choose One

name

Raj's fav color classes

delete

Showing 6 to 10 of 10

<<<12>>>

Class	Color
Mitochondrion (cell structure) <http://snomed.info/id/75056005>	delete
Name Unknown	delete
heart	delete
Heart structure (body structure) <http://snomed.info/id/80891009>	delete
Heartburn (finding) <http://snomed.info/id/16331000>	delete
Heart beat (observable entity) <http://snomed.info/id/248646004>	delete
Heart failure (disorder) <http://snomed.info/id/84114007>	delete
Heart part (body structure) <http://snomed.info/id/119202000>	
Heart rate (observable entity) <http://snomed.info/id/364075005>	
Computed tomography of heart (procedure) <http://snomed.info/id/241547009>	

localhost:8888/user/colorclasses?8-2.-sform-form-prv-2-childRepeatingView-1-table-topToolbars-toolbars-1-span-navigator-navigation-1-pageLink

@prefix dash: <https://datashapes.org/dash#> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix so: <https://schema.org/> .
@prefix sh: <http://www.w3.org/ns/shacl#> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@prefix hal: <https://halcyon.is/ns/> .

hal:AnnotationClassListShape a sh:NodeShape ;
 sh:targetClass hal:AnnotationClassList ;
 sh:property [a sh:PropertyShape ;
 sh:path so:name ;
 sh:name "Annotation List";
 sh:order 1 ;
 sh:maxLength 200;
 sh:datatype xsd:string ;
 sh:defaultValue "Type your new name here";
 sh:message "Issues with your name"@en
];

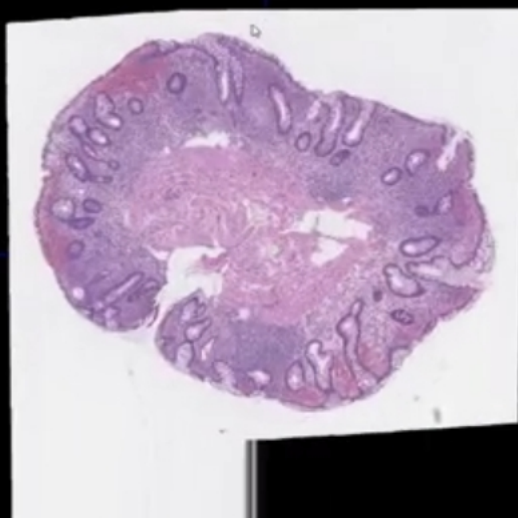
 sh:property [a sh:PropertyShape ;
 sh:path hal:hasAnnotationClass ;
 dash:viewer dash:ValueTableView ;
 sh:nodeKind sh:BlankNode;
 sh:order 0 ;
 sh:maxLength 20;
 sh:node hal:AnnotationClassShape ;
 sh:group hal:ColorGroup
].

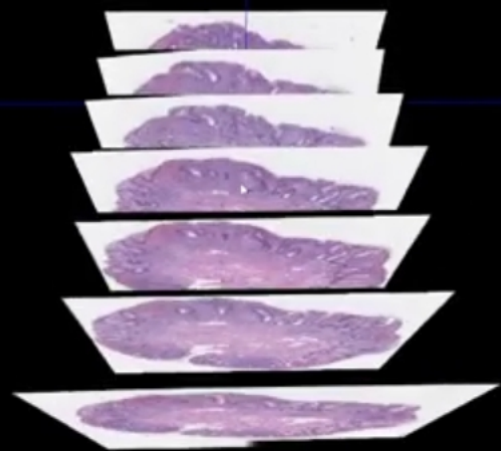
hal:ColorGroup a sh:PropertyGroup; sh:order 0; rdfs:label "MY ACTUAL LIST OF COLORS" .

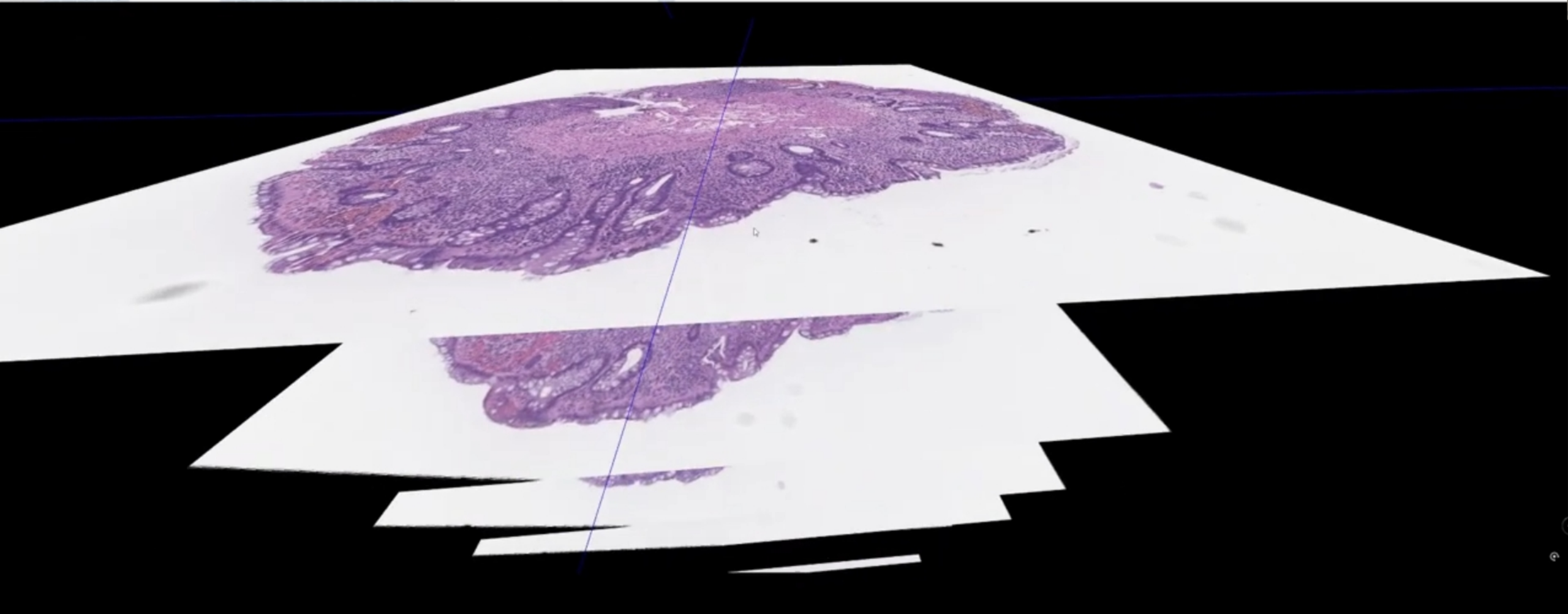
hal:AnnotationClassShape a sh:NodeShape ;
 sh:targetClass hal:AnnotationClass ;
 sh:property [a sh:PropertyShape ;
 sh:path hal:hasClass ;
 sh:name "Class";
 sh:nodeKind sh:IRI;
 sh:order 0;
 sh:minCount 1;
 sh:maxLength 1;
 dash:viewer hal:SNOMEDEditor;
 dash:editor hal:SNOMEDEditor;
 sh:defaultValue <http://mydomain.edu/ns/dummyclass>;
 sh:message "must have one and only one class specified"@en
];

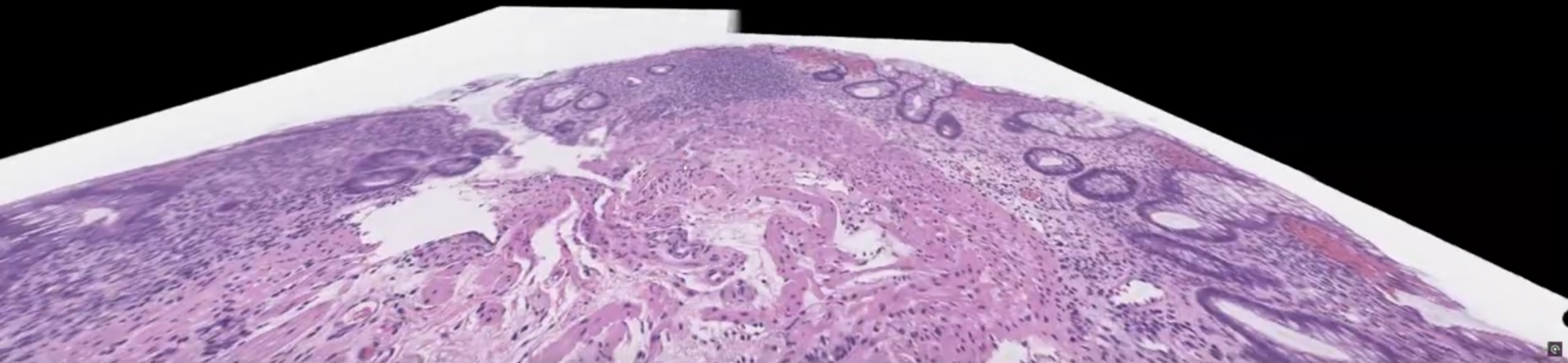
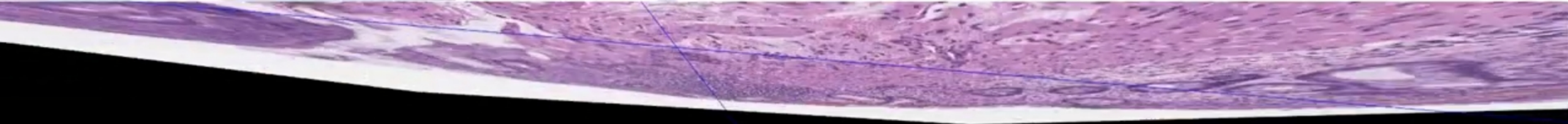
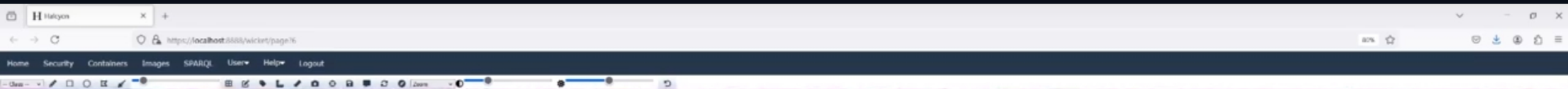
 sh:property [a sh:PropertyShape ;
 sh:path hal:color ;
 sh:name "Color";
 sh:order 2;
 sh:datatype xsd:string ;
 sh:pattern "^[0-9a-fA-F]{6}\$" ;
 sh:defaultValue "#####";
 sh:minCount 1;
 sh:maxLength 1;
 dash:viewer hal:ColorViewer;
 dash:editor hal:ColorEditor;
 sh:message "Problem with your color"@en
].

1.









-- Select Color --



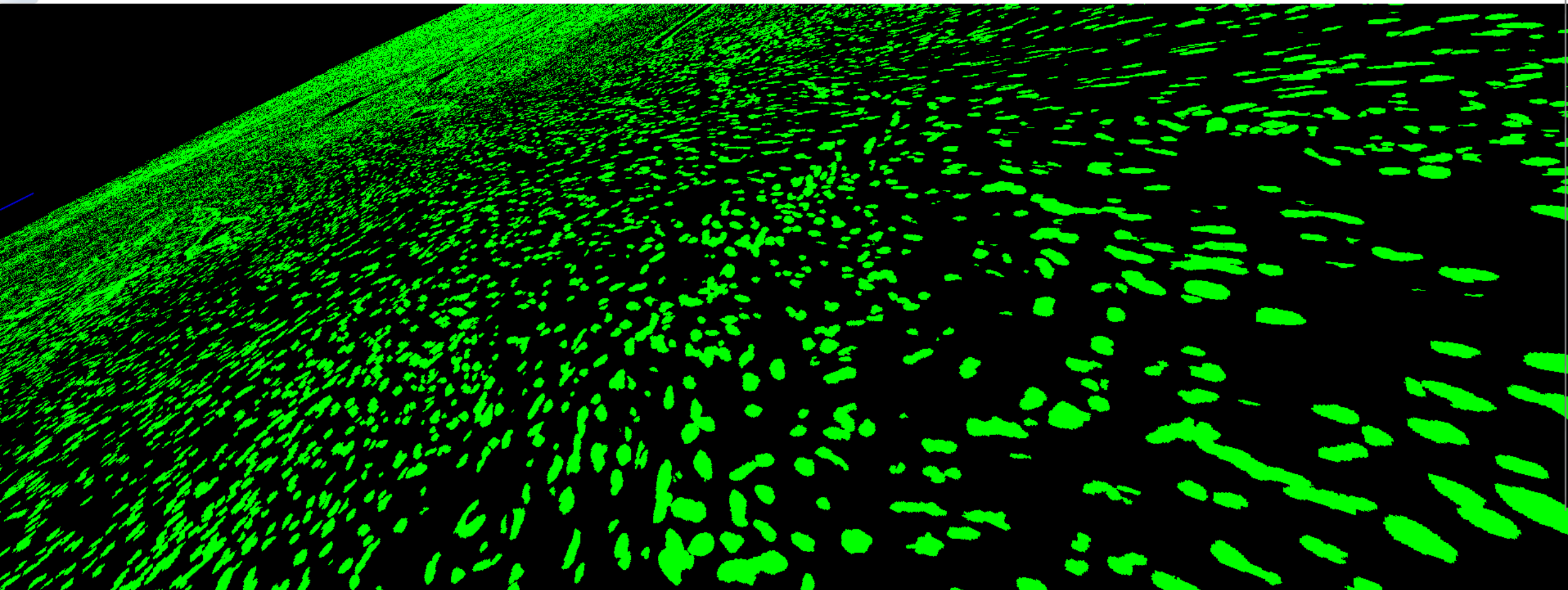
10

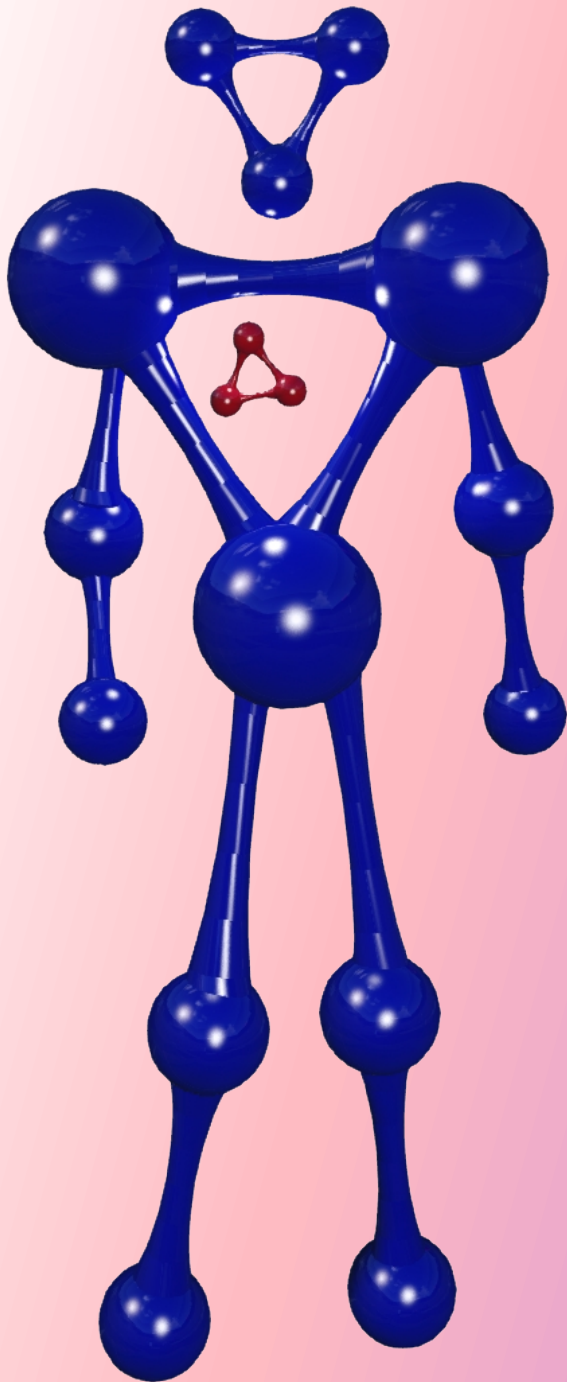


Zoom



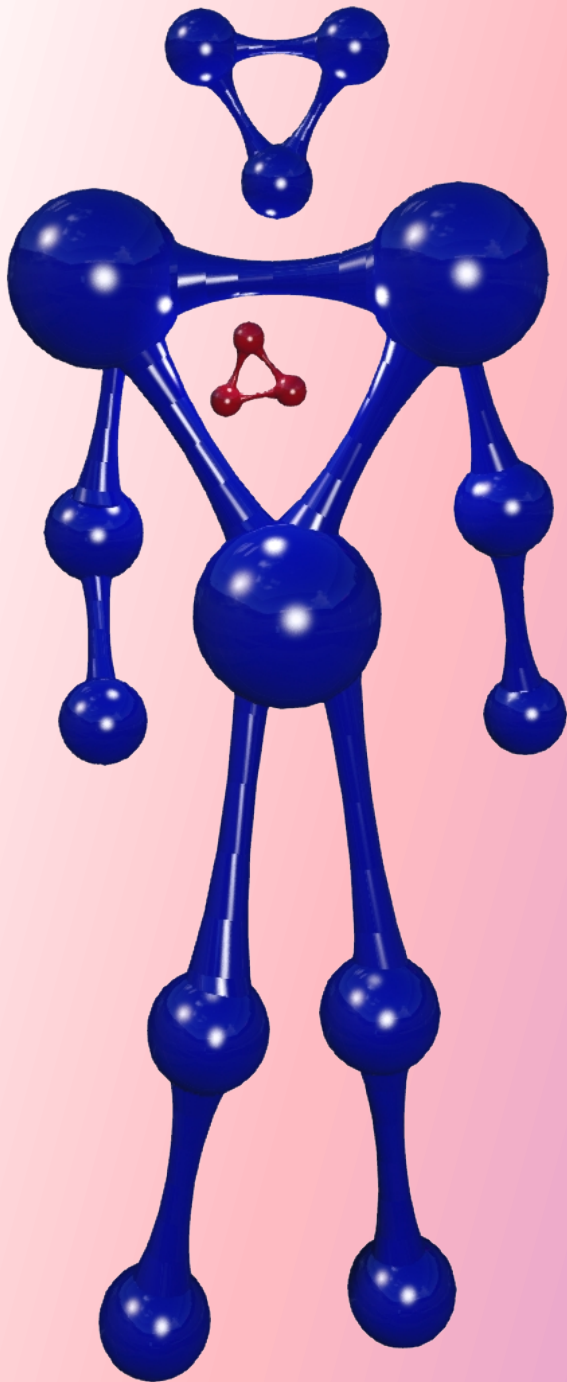
TCGA-CM-5348-01Z-00-DX1.2ad0b8f6-684a-41a7-b568-26e97675cce9.zip





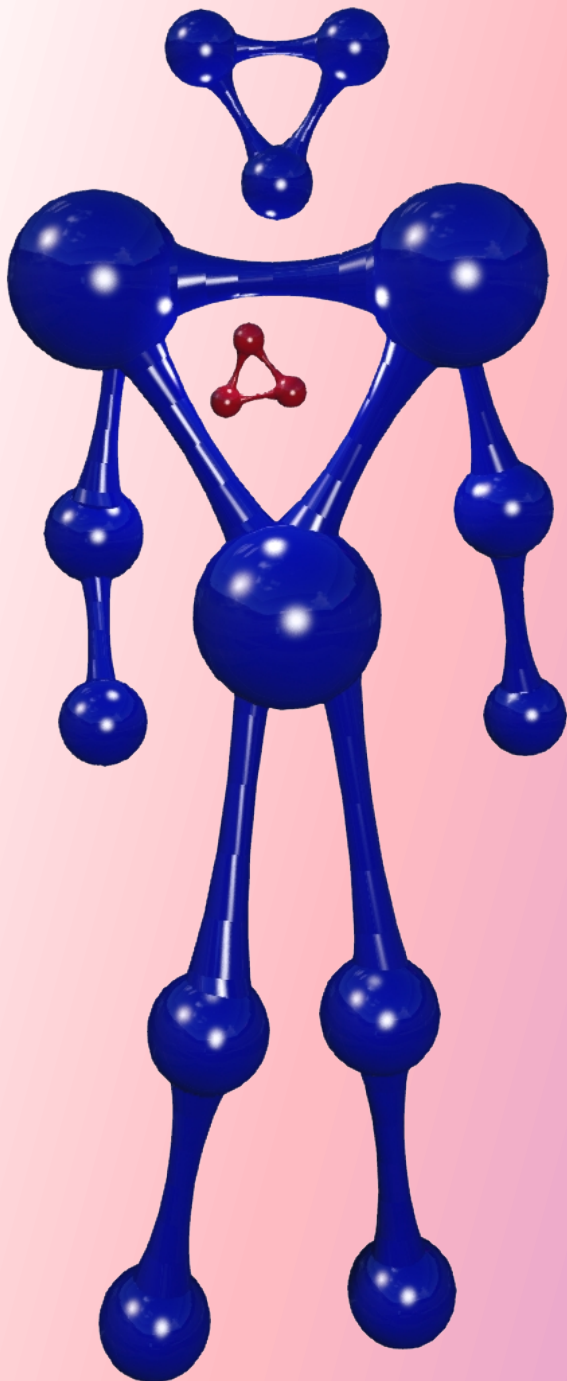
Things to do before version 1 release

- i. Modeling of image and feature stacks
- ii. DICOM Pathology WSI support
- iii. GeoSPARQL operators
- iv. Code cleanup

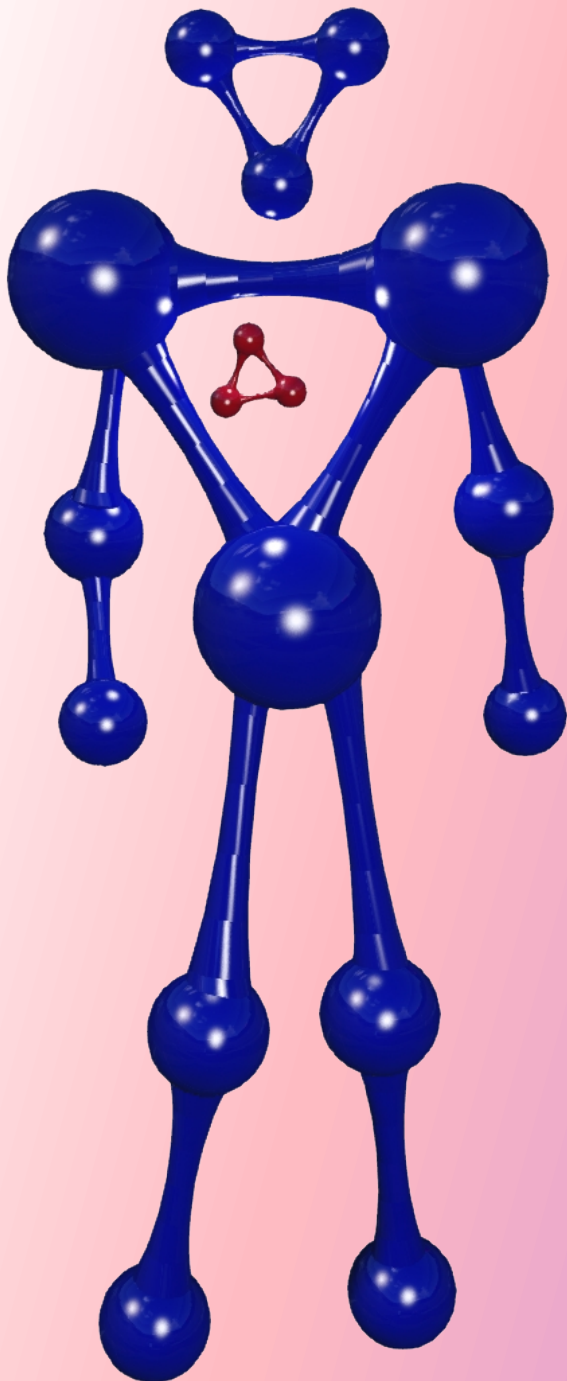


Roadmap

- i. Federated Learning
- ii. LLM-Driven query interface using SHACL-RAG
- iii. Alignment of storage with W3C LWS



Demo



Q&A