

Klaipeda University Marine Research Institute

SEABED VIDEO-IMAGERY ANALYSIS: METHODS AND APPLICATION

E2

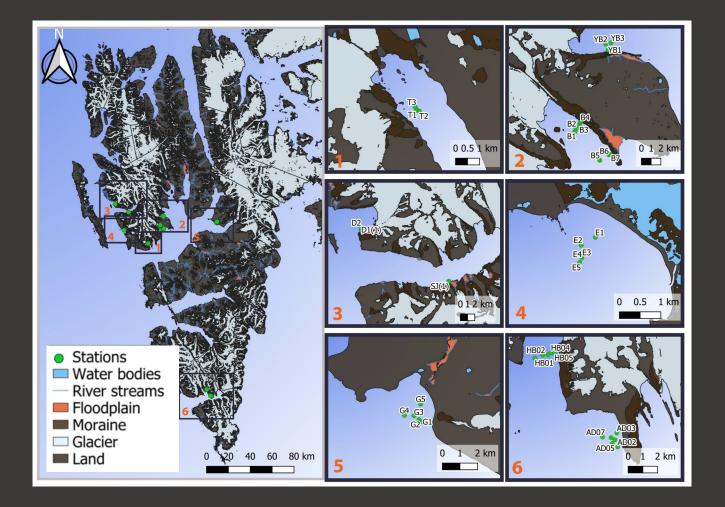
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Klaipėda

2020

Methods and Study area

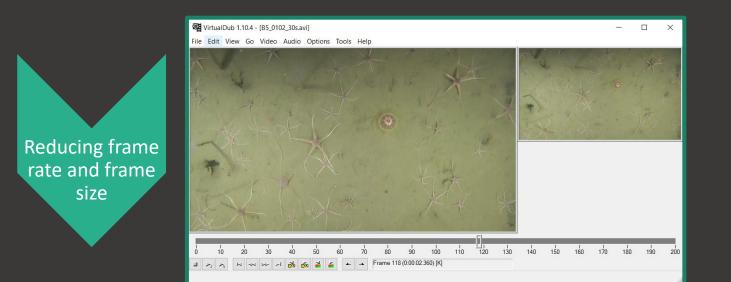
- An underwater video survey was carried out during 2018-2019 summer months in 9 bays;
- In total 271 min of video material were collected
- Video footage was transformed into 204 video mosaics which were used for visual analysis.



Prt. 1

Video preprocessing





Prt.2

Enhancing

Contrast

Pair-wise registration

age Sequence Movie

sut movie:

C:\Users\Lenovo\Desktop\85_0102_30s_5fps.av

C-Users\Lenovo\Desktop\85 0102 30s 50s ce.av

Output RRA: C:\Users\Lenovo\Desktop\B5_0102_30s_5fps_ce.rra

Registrations: Good

0011<-0012 4.0041260 -58.3967568 0.006448851 -0.1633497 (88.21, 29.530) 0012<-0013 -0.8715990 -46.598335 0.006161300 -0.1019255 (90.53, 25.695) 0013<-0014 -2.7938257 -41.8637162 -0.000805447 -0.2135989 (92.12, 23.603) 0014<-0015 -2.5195321 -44.0852247 -0.007546490 -0.1878816 (92.21, 24.711)

0015<-0116 0.5304464 445.1553403 4.014654092 0.2319817 (1.184, 25.507) 0015<-0017 6.6247568 -54.007063 -0.019064011 -0.1484280 (90.91, 29.772) 12.3131923 -62.6643336 -0.021252989 -0.1133257 (89.23, 34.076)

Registe

Exit

Browse ...

Browse...

Biggest scale form

Offset: 0

Gain: 1

📚 🕲 😫

0

Bad

Mosaicing

0002/0004 4.

Pair-wise registration manually if needed





NORR

iew Play Naviga

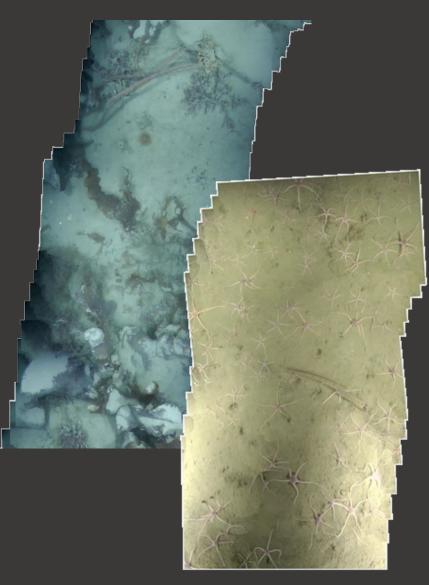


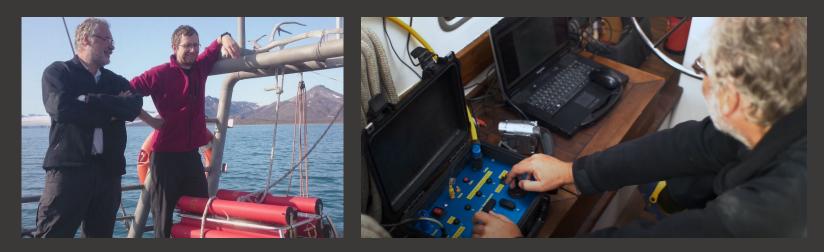
BuildMosaic

Movie: C:\Users\Lenovo\Desktop	\85_0102_30s_5fps.a	Frame range: from-	0 to= 19	
Relative RRAs Relative H	4s World HMs	Validity mask	ity mask Trust coefficient:	
Mosaic size estimate Do estimate		154 Anchor X ⁺ 321 Anchor Y ⁺	618 1565	
Output Scheme 4 - Graph cut Layer width: 10	Tiles Use tiles Create	Tile parameters	Extras Outlines image Centers file	
Colour Validate Validate Validate Validate Validate Output after each frame	Assemb		Curl file 3MP2GeoTIFF file World HM	
C Output patches	Frame invalid: (0,0,	.0)	Mosaic-frame mapping	
Frame Tile -: F 18	85_0102_30s_5fps.bmp		Create mosaic	
Exit			0	



Video mosaicing





Data	Vietovė	ROV tran./min	UW moz.
24.07.2019	Gipsvika	5 / 60 min	67
26.07.2019	Yoldiabukta	3 / 30 min	1
27.07.2019	Borebukta	7 / 68 min	43
27.07.2019 28.07.2019	Eidembukta	3 / 15 min	15
29.07.2019	St. Johnsfjorden	1 / 17 min	10
29.07.2019	Dahlbrebukta	2 / 37 min	11
30.07.2019	Trygghamma	3 / 31 min	19
31.07.2018	Adriabukta	7 /27 min	24
31.07.2018	Burgerbukta	5 / 14 min	14
lš viso		26 /271 min	204

Features ID

- Features identification catalogue was created and freely available to anyone who received a link;
- 72 features were identified to the least possible taxonomic level. Common identified features were Mollusca (19), Arthropoda (13) and Annelida (11)
- To avoid possible errors it was decided to use higher taxonomic rank for features that were debatable, physical features were discarded so at the end 43 most reliable ones were used for further analysis.
- Many thanks to prof. Marcin Węsławski, dr. Yuri Kantor, dr. Alexey V. Golikov, dr. Piotr Balazy, Kajatan Deja, V. Spiridonov, Aleksandr I. Kokorin and Vitaly L. Syomin who helped with the taxonomic identification of benthic species.
- Some pisces and bryozoa are still not fully identified. Identification of these groups would increase diversity.

FEATURES IDENTIFICATION ECHINODERMATA valbard 2019 Urasterias lincki 2019-07-29. St. Johnsfiord. st. SI(2), depth 40 m Phyllum: Echinodermata Class: Asteroidea Order: Forcioulatida Familly: Asteriidae Genus: Urasteria

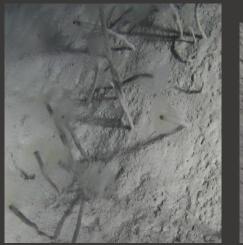
Your comments/approval: Urasterias lincki - approved Kajetan

Features ID

- Some features belongs to the same taxonomic rank, but one is identified to lower rank than other e.g. *Euchone* sp. belongs to Sabellidae family, but Sabelidae is also a feature that was given to an object which was hard to determine to species level;
- Similar example with **Bivalve siphon** and **Mya sp. siphon** features, both are Bivalves, however **Mya sp. siphon** is identified to lower taxonomic rank of genus.
- Some features were hard to identified due to a lack of image quality



Balanus or Mytilus?



Euchone sp. feature



Sabellidae feature



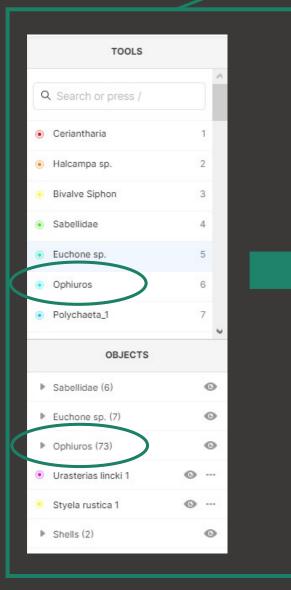
Mya sp. siphon

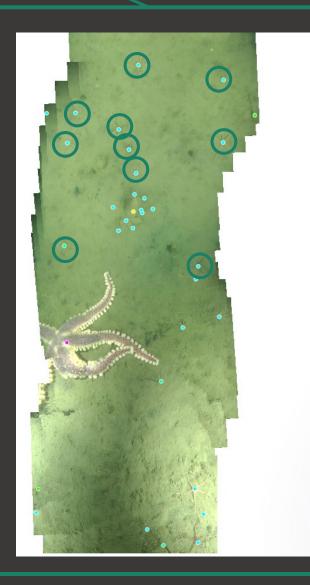
Bivalve siphon

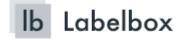


Counting features

 Labelbox is a powerful image/video labeling tool for image classification, object detection and segmentation, here we used it for feature labeling on mosaics.







Not only for counting

- Image segmentation and annotation of visual features.
- Extraction of biological information (abundance, dimensions of objects, area, etc.).
- Opportunities for automated image recognition.



TOOLS					
z	Tube dwelling polychaetes	1			
2	Shrimps	2			
	Bivalvia siphons	3			
z	Gastropoda	4			
2	Pisces	5			
2	Infaunal polychaetes	6			
2	Bryozoa	7			
2	Hyas species	8			
2	Urasterias lincki	9			
2	Cerianthus Iloydii		,		
OBJECTS					
÷	Bivalvia siphons (2)	\cup			
Þ	Pisces (5)	\cup			
Þ	Bryozoa (4)	\cup	/		
Þ	Alcyonidium gelatinosum (47)	\cup			
Þ	Shells (3)	\cup	^		
Þ	Cobble/Pebble (21)	\cup	2		
Þ	Detritus (9)	\cup	2		
Þ	Barnacle (7)	\cup	1		
2	Hermit crab 1				

Other applications of Arctic video data

DEMERSAL - A deep learning-based automated system for seabed imagery recognition and quantitative analysis

- Creating and sharing of annotated underwater video data for future development of image recognition tools for underwater imagery
- Development of automatic image recognition of Arctic benthos

Together with Kaunas University of Technology



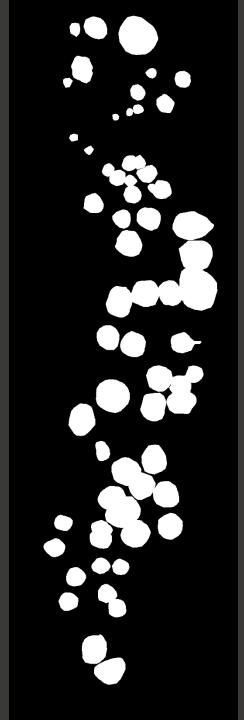
Sharing of annotated data

- Creating and sharing of annotated underwater video data for both biology and IT scientists
- Dataset consists of 47 video mosaics, 12 biological features, 2305 annotated objects, 4 experts

Manuscript for "Data in Brief" journal





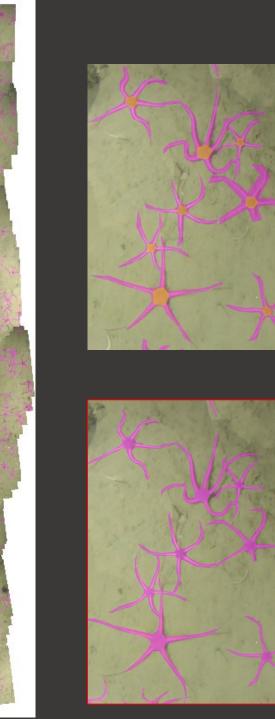


Towards automated image recognition

- Annotation of all objects of one class (Ophiuroidea) in two mosaics
- Two experts
- Deep learning based training
- Accuracy of automated recognition
- Expert sensitivity
- Partial annotation

Manuscript for "Ecological informatics" journal





Thank you!