Benchmark of plankton image classification: CNN improve detection of rare taxa





06/28/2021

















More instruments













More data



news

























































More instruments























3 benchmark datasets



































More instruments















Report performances of two classification approaches Provide baseline results for future comparisons















Number of objects and classes in each dataset





Number of objects and classes in each dataset





Number of objects and classes in each dataset



Distribution of objects per classes in each dataset







Number of objects and classes in each dataset



Distribution of objects per classes in each dataset



Strong unbalance





Number of objects and classes in each dataset



Distribution of objects per classes in each dataset







Number of objects and classes in each dataset



Class-stratified dataset split

Distribution of objects per classes in each dataset







levelName)	level0	nb_level0	level1	nb_level1
1		Pontellidae	239	Pontellidae	239
1	-Rhincalanidae	Rhincalanidae	1	Calanoida	197751
	! ! ! ! ! °Temoridae	Temoridae	14638	Temoridae	14638
!	!!!!-copepoda-cut	copepoda-cut	9666	Copepoda	18557
!	! ! ! ! !Cvclopoida				
1	°Oithonidae	Oithonidae	129334	Cyclopoida	139175
1		oithonidae-badfocus	4111	Cyclopoida	139175
1		oithonidae-face-view	4569	Cyclopoida	139175
1		oithonidae-side-view-no-antena	1161	Cyclopoida	139175
1		dead <conenada< td=""><td>17243</td><td>empty Copenada</td><td>17243</td></conenada<>	17243	empty Copenada	17243
1		Harpacticoida	645	Harpacticoida	645
1		dead	610	ampty Harpacticoida	619
1			1440	Entroine	1449
i	i i i i i-Euterpina	Euterpina	1449	Euterpina	219
i		Microsetella	318	Microstella	510
1	multiple	multiple <copepoda< td=""><td>5750</td><td>multiple_Copepoda</td><td>5750</td></copepoda<>	5750	multiple_Copepoda	5750
1	°Poecilostomatoida	Poecilostomatoida	679	Poecilostomatoida	692
	Corycaeidae	Corycaeidae	3659	Corycaeidae	3659
1	Oncaeidae				
1	°Oncaea	Oncaea	23336	Oncaea	23336
1	¦ ¦ ¦ ¦ °Sapphirinidae	Sapphirinidae	13	Poecilostomatoida	692
	°Thecostraca				
1	°Cirripedia				
1	cypris	cypris	862	Ciripedia	8287
1	¦¦¦ °nauplii	nauplii <cirripedia< td=""><td>7425</td><td>Ciripedia</td><td>8287</td></cirripedia<>	7425	Ciripedia	8287
1	¦ ¦ ¦nauplii	nauplii <crustacea< td=""><td>4637</td><td>nauplii_Crustacea</td><td>4637</td></crustacea<>	4637	nauplii_Crustacea	4637
1	¦ ¦Oligostraca				
ł	¦ ¦ ¦ °Ostracoda	Ostracoda	73	other_living	25454
ł	¦ ¦ °tail	tail <crustacea< td=""><td>567</td><td>part_Crustacea</td><td>1264</td></crustacea<>	567	part_Crustacea	1264
1	°Hexapoda				
ł	°Insecta	Insecta	2	detritus	204132
1	Bryozoa				
ł	°cyphonaute	cyphonaute	1593	cyphonaute	1593
1	Chaetognatha	Chaetognatha	3086	Chaetognatha	3150
1	°tail	tail <chaetognatha< td=""><td>64</td><td>Chaetognatha</td><td>3150</td></chaetognatha<>	64	Chaetognatha	3150
ł	Chordata				
1	Cephalochordata				
1	¦ °Branchiostomidae				
1	¦ °Branchiostoma	Branchiostoma	18	other_living	25454
1	Craniata				
1	°Vertebrata				
1	°Gnathostomata				400
1	°Actinopterygii	Actinopterygii	100	Actinopterygii	100
1	-Clupeiformes temp				
1	Clupeidae temp				
i	i i iSardina temp				7764
1	i i i "egg unkn temp	egg unkn temp <sardina td="" temp<=""><td>7754</td><td>egg_Sardina</td><td>//54</td></sardina>	7754	egg_Sardina	//54
i	i i iEngraulidae temp				11155
1	i i i °egg unkn temp	egg unkn temp <engraulidae td="" ter<=""><td>41455</td><td>egg_Engraudilae</td><td>41455</td></engraulidae>	41455	egg_Engraudilae	41455
ł	egg	egg <actinopterygii< td=""><td>5138</td><td>egg_Actinopterygii</td><td>5138</td></actinopterygii<>	5138	egg_Actinopterygii	5138



• include every object

levelName)	level0	nb_level0	level1	nb_level1
1		Pontellidae	239	Pontellidae	239
1	-Rhincalanidae	Rhincalanidae	1	Calanoida	197751
	! ! ! ! ! °Temoridae	Temoridae	14638	Temoridae	14638
!	!!!!-copepoda-cut	copepoda-cut	9666	Copepoda	18557
!	! ! ! ! !Cvclopoida				
1	°Oithonidae	Oithonidae	129334	Cyclopoida	139175
1		oithonidae-badfocus	4111	Cyclopoida	139175
1		oithonidae-face-view	4569	Cyclopoida	139175
1		oithonidae-side-view-no-antena	1161	Cyclopoida	139175
1		dead <conenada< td=""><td>17243</td><td>empty Copenada</td><td>17243</td></conenada<>	17243	empty Copenada	17243
1		Harpacticoida	645	Harpacticoida	645
1		dead	610	ampty Harpacticoida	619
1			1440	Entroine	1449
i	i i i i i-Euterpina	Euterpina	1449	Euterpina	219
i		Microsetella	318	Microstella	510
1	multiple	multiple <copepoda< td=""><td>5750</td><td>multiple_Copepoda</td><td>5750</td></copepoda<>	5750	multiple_Copepoda	5750
1	°Poecilostomatoida	Poecilostomatoida	679	Poecilostomatoida	692
	Corycaeidae	Corycaeidae	3659	Corycaeidae	3659
1	Oncaeidae				
1	°Oncaea	Oncaea	23336	Oncaea	23336
1	¦ ¦ ¦ ¦ °Sapphirinidae	Sapphirinidae	13	Poecilostomatoida	692
	°Thecostraca				
1	°Cirripedia				
1	cypris	cypris	862	Ciripedia	8287
1	¦¦¦ °nauplii	nauplii <cirripedia< td=""><td>7425</td><td>Ciripedia</td><td>8287</td></cirripedia<>	7425	Ciripedia	8287
ł	¦ ¦ ¦nauplii	nauplii <crustacea< td=""><td>4637</td><td>nauplii_Crustacea</td><td>4637</td></crustacea<>	4637	nauplii_Crustacea	4637
1	¦ ¦Oligostraca				
ł	¦ ¦ ¦ °Ostracoda	Ostracoda	73	other_living	25454
ł	¦ ¦ °tail	tail <crustacea< td=""><td>567</td><td>part_Crustacea</td><td>1264</td></crustacea<>	567	part_Crustacea	1264
1	°Hexapoda				
ł	°Insecta	Insecta	2	detritus	204132
1	Bryozoa				
ł	°cyphonaute	cyphonaute	1593	cyphonaute	1593
1	Chaetognatha	Chaetognatha	3086	Chaetognatha	3150
1	°tail	tail <chaetognatha< td=""><td>64</td><td>Chaetognatha</td><td>3150</td></chaetognatha<>	64	Chaetognatha	3150
ł	Chordata				
1	Cephalochordata				
1	¦ °Branchiostomidae				
1	¦ °Branchiostoma	Branchiostoma	18	other_living	25454
1	Craniata				
1	°Vertebrata				
1	°Gnathostomata				400
1	°Actinopterygii	Actinopterygii	100	Actinopterygii	100
1	-Clupeiformes temp				
1	Clupeidae temp				
i	i i iSardina temp				7764
1	i i i "egg unkn temp	egg unkn temp <sardina td="" temp<=""><td>7754</td><td>egg_Sardina</td><td>//54</td></sardina>	7754	egg_Sardina	//54
i	i i iEngraulidae temp				11155
1	i i i °egg unkn temp	egg unkn temp <engraulidae td="" ter<=""><td>41455</td><td>egg_Engraudilae</td><td>41455</td></engraulidae>	41455	egg_Engraudilae	41455
ł	egg	egg <actinopterygii< td=""><td>5138</td><td>egg_Actinopterygii</td><td>5138</td></actinopterygii<>	5138	egg_Actinopterygii	5138



- include **every** object
- as detailed as possible... but small classes

levelNan	ne	level0	nb_level0	level1	nb_level1
1	Pontellidae	Pontellidae	239	Pontellidae	239
1	Rhincalanidae	Rhincalanidae	1	Calanoida	197751
	°Temoridae	Temoridae	14638	Temoridae	14638
!	!!!!!copepoda-cut	copepoda-cut	9666	Copepoda	18557
1	! ! ! !Cvclopoida			0000000	
!	!!!!! °Oithonidae	Oithonidae	129334	Cyclopoida	139175
!	!!!!!!!oithonidae-badfocus	oithonidae-badfocus	4111	Cyclopoida	139175
1	! ! ! ! !oithonidae-face-view	oithonidae-face-view	4569	Cyclopoida	139175
1	1 1 1 1 °oithonidae-side-view-no-ante	oithonidae-side-view-no-antena	1161	Cyclopoida	139175
1		dead <conenoda< td=""><td>17243</td><td>empty Copenda</td><td>17243</td></conenoda<>	17243	empty Copenda	17243
ı İ		Harpacticoida	645	Harpacticoida	645
1		dead <harpacticoida< td=""><td>619</td><td>empty Harpacticoida</td><td>619</td></harpacticoida<>	619	empty Harpacticoida	619
1		Eutoroina	1440	empty_harpacticolda	1449
1		Microsotello	219	Euterpina	318
i			516	Microstella	5750
i		multiple <copepoda< td=""><td>5750</td><td>multiple_Copepoda</td><td>5750</td></copepoda<>	5750	multiple_Copepoda	5750
1	°Poecilostomatoida	Poecilostomatoida	679	Poecilostomatoida	092
1	Corycaeidae	Corycaeidae	3659	Corycaeidae	3628
i		•			00000
1	°Oncaea	Oncaea	23336	Oncaea	23330
1	°Sapphirinidae	Sapphirinidae	13	Poecilostomatoida	692
1					
i		e mede	000		0007
i	i i i icypris	cypris	862	Ciripedia	0207
1	i i [°] nauplii	nauplii <cirripedia< td=""><td>7425</td><td>Ciripedia</td><td>8287</td></cirripedia<>	7425	Ciripedia	8287
1	nauplii	nauplii <crustacea< td=""><td>4637</td><td>nauplii_Crustacea</td><td>4637</td></crustacea<>	4637	nauplii_Crustacea	4637
1	Oligostraca				05454
1	°Ostracoda	Ostracoda	73	other_living	25454
1	°tail	tail <crustacea< td=""><td>567</td><td>part_Crustacea</td><td>1264</td></crustacea<>	567	part_Crustacea	1264
1	Hexapoda				004400
1	°Insecta	Insecta	2	detritus	204132
1	Bryozoa				4500
1	°cyphonaute	cyphonaute	1593	cyphonaute	1593
1	Chaetognatha	Chaetognatha	3086	Chaetognatha	3150
	°tail	tail <chaetognatha< td=""><td>64</td><td>Chaetognatha</td><td>3150</td></chaetognatha<>	64	Chaetognatha	3150
1	Chordata				
i	i iGephalochordata				
i	i ibranchiostomidae	Dranabiastana	10	attend to be	25454
i	i ibranchiostoma	Branchiostoma	18	other_living	20404
i					
i	- vertebrata				
i		Actinenterusii	100	A stin enter wit	100
i	i iAcunopterygii	Actinopterygii	100	Actinopterygii	100
1	L L L-Cluneidae temp				
1	°Sardina temp				
1		egg unkn temps Sardina temp	7754	ora Sardina	7754
1	°Engraulidae temp	egg unkn temp <oaruina td="" temp<=""><td>1754</td><td>egg_oardina</td><td>1104</td></oaruina>	1754	egg_oardina	1104
1		egg unkn tempsEngraulidae ter	41455	ega Engraudilae	41455
1		egg antin tomp - Engraduidae ter	5138	egg_Lingraddiae	5138
i	i i-egg	egg~Actinopterygli	5136	egg_Actinopterygli	0100



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 - if possible, merge with close relevant class

elName	level0	nb_level0	level1	nb_level1
Pontellidae	Pontellidae	239	Pontellidae	23
-Rhincalanida	ae Rhincalanidae	1	Calanoida	19775
°Temoridae	Temoridae	14638	Temoridae	1463
copepoda-cut	copepoda-cut	9666	Copepoda	1855
Cyclopoida				
°Oithonidae	Oithonidae	129334	Cyclopoida	13917
	e-badfocus oithonidae-badfocus	4111	Cvclopoida	13917
!!!!!!-oithonidae	e-face-view oithonidae-face-view	4569	Cvclopoida	13917
! ! ! ! °oithonida	e-side-view-no-ante oithonidae-side-view-no-anten	a 1161	Cyclopoida	13917
l l l l-dead	dead <copepoda< td=""><td>17243</td><td>empty Copepoda</td><td>1724</td></copepoda<>	17243	empty Copepoda	1724
	Harpacticoida	645	Harnacticoida	64
	dead <harpacticoida< td=""><td>610</td><td>ampty Harpacticoida</td><td>61</td></harpacticoida<>	610	ampty Harpacticoida	61
		1110	empty_harpacticoida	144
i i i i iEuterpina	Euterpina	1449	Euterpina	144
°Microsetella	Microsetella	318	Microstella	31
multiple	multiple <copepoda< td=""><td>5750</td><td>multiple_Copepoda</td><td>5/5</td></copepoda<>	5750	multiple_Copepoda	5/5
°Poecilostomate	oida Poecilostomatoida	679	Poecilostomatoida	69
Corycaeidae	e Corycaeidae	3659	Corycaeidae	365
Oncaeidae				
°Oncaea	Oncaea	23336	Oncaea	2333
°Sapphirinida	ae Sapphirinidae	13	Poecilostomatoida	69
¦ ¦ ¦ °Thecostraca				
¦ ¦ ¦ °Cirripedia				
cypris	cypris	862	Ciripedia	828
¦¦¦ °nauplii	nauplii <cirripedia< td=""><td>7425</td><td>Ciripedia</td><td>828</td></cirripedia<>	7425	Ciripedia	828
¦ ¦ ¦nauplii	nauplii <crustacea< td=""><td>4637</td><td>nauplii_Crustacea</td><td>463</td></crustacea<>	4637	nauplii_Crustacea	463
Oligostraca				
°Ostracoda	Ostracoda	73	other_living	2545
°tail	tail <crustacea< td=""><td>567</td><td>part Crustacea</td><td>126</td></crustacea<>	567	part Crustacea	126
°Hexapoda			· _	
°Insecta	Insecta	2	detritus	20413
Bryozoa				
! °cvphonaute	cyphonaute	1593	cyphonaute	159
Chaetognatha	Chaetognatha	3086	Chaetognatha	315
°tail	tail <chaetognatha< td=""><td>64</td><td>Chaetognatha</td><td>31</td></chaetognatha<>	64	Chaetognatha	31
Chordata	tairsonaetognatila	04	Chaeloghatha	UN
Cephalochordata				
°Branchiostomidae				
Branchiostoma	Branchiostoma	18	other living	2545
l !Craniata	Branchiostoma	10	ould_iving	2010
! ! °Vertebrata				
!! °Gnathostomata				
	Actinontervaji	100	Actinontervaii	10
!Clupeiforme	stemp	100	Actiliopterygi	, in the second s
Cluneidae	temp			
°Sardin	a temp			
	unkn temn	7754	ega Sardina	77
IIIIIegg	ae temp	1154	egg_oardina	110
	detemp			
	kn town	A1455	can Engravelle	A145



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elName	level0	nb_level0	level1	nb_level1
Pontellidae	Pontellidae	239	Pontellidae	23
-Rhincalanida	ae Rhincalanidae	1	Calanoida	19775
°Temoridae	Temoridae	14638	Temoridae	1463
copepoda-cut	copepoda-cut	9666	Copepoda	1855
Cyclopoida				
°Oithonidae	Oithonidae	129334	Cyclopoida	13917
	e-badfocus oithonidae-badfocus	4111	Cvclopoida	13917
!!!!!!-oithonidae	e-face-view oithonidae-face-view	4569	Cvclopoida	13917
	e-side-view-no-ante oithonidae-side-view-no-anten	a 1161	Cyclopoida	13917
l l l l-dead	dead <copepoda< td=""><td>17243</td><td>empty Copepoda</td><td>1724</td></copepoda<>	17243	empty Copepoda	1724
	Harpacticoida	645	Harnacticoida	64
	dead <harpacticoida< td=""><td>610</td><td>ampty Harpacticoida</td><td>61</td></harpacticoida<>	610	ampty Harpacticoida	61
		1110	empty_narpacticoida	144
i i i i iEuterpina	Euterpina	1449	Euterpina	144
°Microsetella	Microsetella	318	Microstella	31
multiple	multiple <copepoda< td=""><td>5750</td><td>multiple_Copepoda</td><td>5/5</td></copepoda<>	5750	multiple_Copepoda	5/5
°Poecilostomate	oida Poecilostomatoida	679	Poecilostomatoida	69
Corycaeidae	e Corycaeidae	3659	Corycaeidae	365
Oncaeidae				
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°Sapphirinida	ae Sapphirinidae	13	Poecilostomatoida	69
¦ ¦ ¦ °Thecostraca				
¦ ¦ ¦ °Cirripedia				
cypris	cypris	862	Ciripedia	828
¦¦¦ °nauplii	nauplii <cirripedia< td=""><td>7425</td><td>Ciripedia</td><td>828</td></cirripedia<>	7425	Ciripedia	828
¦ ¦ ¦nauplii	nauplii <crustacea< td=""><td>4637</td><td>nauplii_Crustacea</td><td>463</td></crustacea<>	4637	nauplii_Crustacea	463
Oligostraca				
°Ostracoda	Ostracoda	73	other_living	2545
°tail	tail <crustacea< td=""><td>567</td><td>part Crustacea</td><td>126</td></crustacea<>	567	part Crustacea	126
°Hexapoda			· _	
°Insecta	Insecta	2	detritus	20413
Bryozoa				
! °cvphonaute	cyphonaute	1593	cyphonaute	159
Chaetognatha	Chaetognatha	3086	Chaetognatha	315
°tail	tail <chaetognatha< td=""><td>64</td><td>Chaetognatha</td><td>31</td></chaetognatha<>	64	Chaetognatha	31
Chordata	tairsonaetognatila	04	Chaeloghatha	UN
Cephalochordata				
°Branchiostomidae				
- Branchiostoma	Branchiostoma	18	other living	2545
l !Craniata	Branchiostoma	10	ould_iving	2010
! ! °Vertebrata				
!! °Gnathostomata				
	Actinontervaji	100	Actinontervaii	10
!Clupeiforme	stemp	100	Actiliopterygi	, in the second s
Cluneidae	temp			
°Sardin	a temp			
	unkn temn	7754	ega Sardina	77
IIIIIegg	ae temp	1154	egg_oardina	110
	detemp			
	kn town	A1455	can Engravelle	A145



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- define broader classes corresponding to traditional approaches (e.g. Copepoda)

elName	level0	nb_level0	level1	nb_level1
Pontellidae	Pontellidae	239	Pontellidae	23
-Rhincalanida	ae Rhincalanidae	1	Calanoida	19775
°Temoridae	Temoridae	14638	Temoridae	1463
copepoda-cut	copepoda-cut	9666	Copepoda	1855
Cyclopoida				
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	e-badfocus oithonidae-badfocus	4111	Cvclopoida	13917
!!!!!!-oithonidae	e-face-view oithonidae-face-view	4569	Cvclopoida	13917
! ! ! ! °oithonida	e-side-view-no-ante oithonidae-side-view-no-anten	a 1161	Cyclopoida	13917
l l l l-dead	dead <copepoda< td=""><td>17243</td><td>empty Copepoda</td><td>1724</td></copepoda<>	17243	empty Copepoda	1724
	Harpacticoida	645	Harnacticoida	64
	dead <harpacticoida< td=""><td>610</td><td>ampty Harpacticoida</td><td>61</td></harpacticoida<>	610	ampty Harpacticoida	61
		1110	empty_narpacticoida	144
i i i i iEuterpina	Euterpina	1449	Euterpina	144
°Microsetella	Microsetella	318	Microstella	31
multiple	multiple <copepoda< td=""><td>5750</td><td>multiple_Copepoda</td><td>5/5</td></copepoda<>	5750	multiple_Copepoda	5/5
°Poecilostomate	oida Poecilostomatoida	679	Poecilostomatoida	69
Corycaeidae	e Corycaeidae	3659	Corycaeidae	365
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¦ ¦ ¦ °Thecostraca				
¦ ¦ ¦ °Cirripedia				
cypris	cypris	862	Ciripedia	828
¦¦¦ °nauplii	nauplii <cirripedia< td=""><td>7425</td><td>Ciripedia</td><td>828</td></cirripedia<>	7425	Ciripedia	828
¦ ¦ ¦nauplii	nauplii <crustacea< td=""><td>4637</td><td>nauplii_Crustacea</td><td>463</td></crustacea<>	4637	nauplii_Crustacea	463
Oligostraca				
°Ostracoda	Ostracoda	73	other_living	2545
°tail	tail <crustacea< td=""><td>567</td><td>part Crustacea</td><td>126</td></crustacea<>	567	part Crustacea	126
°Hexapoda			· _	
°Insecta	Insecta	2	detritus	20413
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Chordata	tairsonaetognatila	04	Chaeloghatha	UN
Cephalochordata				
°Branchiostomidae				
Branchiostoma	Branchiostoma	18	other living	2545
l !Craniata	Branchiostoma	10	ould_iving	2010
! ! °Vertebrata				
!! °Gnathostomata				
	Actinontervaji	100	Actinontervaii	10
!Clupeiforme	stemp	100	Actiliopterygi	, in the second s
Cluneidae	temp			
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	unkn temn	7754	ega Sardina	77
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	detemp			
	kn town	A1455	can Engravelle	A145



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 - if possible, merge with close relevant class
 - otherwise, merge with miscellaneous
- define broader classes corresponding to traditional approaches (e.g. Copepoda)
- categorise classes in **plankton classes** or not

levelN	ame	level0	nb_level0	level1	nb_level1
1	Pontellidae	Pontellidae	239	Pontellidae	239
	Rhincalanidae	Rhincalanidae	1	Calanoida	197751
1	°Temoridae	Temoridae	14638	Temoridae	14638
	!!!!!-copepoda-cut	copepoda-cut	9666	Copepoda	18557
!	! ! ! !Cvclopoida				
!	! ! ! ! ! °Oithonidae	Oithonidae	129334	Cyclopoida	139175
1		oithonidae-badfocus	4111	Cyclopoida	139175
1 1		oithonidae-face-view	4569	Cyclopoida	139175
1			4505	Cyclopoida	130175
i	i i i i -ottionidae-side-view-no-ante	olthonidae-side-view-no-antena	17040	Cyclopoida	17242
i	; ; ; ; ;dead	dead <copepoda< td=""><td>17243</td><td>empty_Copepoda</td><td>645</td></copepoda<>	17243	empty_Copepoda	645
i	Harpacticoida	Harpacticoida	645	Harpacticoida	045
1	-dead	dead <harpacticoida< td=""><td>619</td><td>empty_Harpacticoida</td><td>619</td></harpacticoida<>	619	empty_Harpacticoida	619
	-Euterpina	Euterpina	1449	Euterpina	1449
	°Microsetella	Microsetella	318	Microstella	318
	multiple	multiple <copepoda< td=""><td>5750</td><td>multiple_Copepoda</td><td>5750</td></copepoda<>	5750	multiple_Copepoda	5750
!		Poecilostomatoida	679	Poecilostomatoida	692
ł	¦ ¦ ¦ ¦ ¦Corycaeidae	Corycaeidae	3659	Corycaeidae	3659
ł	Oncaeidae				
ł	¦ ¦ ¦ ¦ °Oncaea	Oncaea	23336	Oncaea	23336
1	°Sapphirinidae	Sapphirinidae	13	Poecilostomatoida	692
	°Thecostraca				
	¦ ¦ ¦ °Cirripedia				
1	cypris	cypris	862	Ciripedia	8287
1	°nauplii	nauplii <cirripedia< td=""><td>7425</td><td>Ciripedia</td><td>8287</td></cirripedia<>	7425	Ciripedia	8287
!	! ! !nauplii	nauplii <crustacea< td=""><td>4637</td><td>nauplii Crustacea</td><td>4637</td></crustacea<>	4637	nauplii Crustacea	4637
	Oligostraca	·····			
!	! ! ! °Ostracoda	Ostracoda	73	other living	25454
	°tail	tail <crustacea< td=""><td>567</td><td>part Crustacea</td><td>1264</td></crustacea<>	567	part Crustacea	1264
! !	l °Hexapoda		001	part_ordstacea	.201
1	°Insecta	Insecta	2	detritus	204132
! !	Bryozoa	nisoota	-	demas	201102
1		cynhonaute	1593	cyphonaute	1593
1 1		Chaotagnatha	2096	Chaotogratha	3150
i .		Chaeloghalha	3000	Chaetognatha	2150
i		tall <chaetognatha< td=""><td>64</td><td>Chaetoghatha</td><td>3150</td></chaetognatha<>	64	Chaetoghatha	3150
i 1	jChordala				
i 1	i iCephalochordata				
1		Propoblactomo	10	Alexa Balan	25454
í 1	i i Branchiostoma	branchiostoma	10	other_living	20404
i 1					
i 1	i iveitebrata				
1 1		Actinontonici	100	A ========	100
i I	i iAcunopierygii	Acunopterygii	100	Actinopterygii	100
i 1	i i i-ciupeilormes temp				
1 1	i i iOuperdae temp				
1 1		and unkn town Condina town	7754		7754
i I	i i i iegg unkn temp	egg unkn temp <sardina td="" temp<=""><td>7754</td><td>egg_Sardina</td><td>1154</td></sardina>	7754	egg_Sardina	1154
i	i i i Engraulidae temp	a na suda tana afin matuka s	44.455		44455
í	i i iegg unkn temp	egg unkn temp <engraulidae td="" ter<=""><td>41455</td><td>egg_⊏ngraudilae</td><td>41455</td></engraulidae>	41455	egg_⊏ngraudilae	41455
	egg	egg <actinopterygii< td=""><td>5138</td><td>egg_Actinopterygii</td><td>5138</td></actinopterygii<>	5138	egg_Actinopterygii	5138



Models – class weights

Object number





Material & methods Models – class weights





Material & methods Models – class weights



Copepoda Rhizaria Detritus Annelida









Material & methods Models

Image











Models

Image









Material & methods Models

RF

Image









Material & methods Models









Fit on training data





Fit on training data



Evaluate on validation data









Fit on training data



Evaluate on validation data













Best model parameters











Best model parameters

Re-fit on training data

>













Evaluate on test data



Best model parameters









Material & methods





Model evaluation





Model evaluation







Model evaluation





Accuracy






```
CNN = convolutional neural network
   RF = random forest
   NW = non weighted
```



```
CNN = convolutional neural network
   RF = random forest
  NW = non weighted
```



```
CNN = convolutional neural network
   RF = random forest
```



```
CNN = convolutional neural network
   RF = random forest
```


Model performances on detailed classes

Model CNN NW CNN W RF NW RF W

CNN = convolutional neural network RF = random forest NW = non weighted

Model performances on detailed classes

Model CNN NW CNN W RF NW RF W

CNN = convolutional neural network RF = random forest

Model performances on detailed classes

CNN = convolutional neural network RF = random forest

Model performances on detailed and broader classes

Model CNN NW CNN W RF NW RF W

Model CNN NW CNN W RF NW RF W

Model CNN NW CNN W RF NW RF W

Model CNN NW CNN W RF NW RF W

Concentration [#/m3]

LABORATOIRE Céanographie Villefranche

lrisson et al., in press

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				. 1

Concentration [#/m3]

Irisson et al., in press

Concentration [#/m3]

Concentration [#/m3]

• time and power consumption

time and power consumption

Lots lots lots lots lots lots of data

data availability ullet

Lots of data

Transfer learning

OR

• time and power consumption

Lots lots lots lots lots lots of data

• data availability

• objects size

• time and power consumption

Lots lots lots lots lots lots of data

• data availability

• objects size

Conclusion

- Abundant plankton: RF ~ CNN
- CNN: more details on small classes
 - rare organisms
 - detailed taxonomy
 - low concentrations
- Manual validation

Conclusion

- Abundant plankton: RF ~ CNN
- CNN: more details on small classes
 - rare organisms
 - detailed taxonomy
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Thank you

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https://github.com/ThelmaPana/plankton_classif_benchmark

