
AB
GRAD
CON23

1
00:00:13,009 --> 00:00:10,810
[Music]

2
00:00:14,770 --> 00:00:13,019
great hi everyone

3
00:00:17,390 --> 00:00:14,780
um yeah so my name is Rachel surprise

4
00:00:19,130 --> 00:00:17,400
I'm a PhD candidate at the University of

5
00:00:21,590 --> 00:00:19,140
California Riverside and today I'm going

6
00:00:23,269 --> 00:00:21,600
to be talking to you all about the

7
00:00:25,310 --> 00:00:23,279
sedimentological signatures of

8
00:00:27,830 --> 00:00:25,320
backgrounds in the pre-cambrian a novel

9
00:00:29,870 --> 00:00:27,840
method for their detection automated

10
00:00:31,550 --> 00:00:29,880
detection in remote contexts and

11
00:00:32,510 --> 00:00:31,560
implications for the search for Life on

12
00:00:34,430 --> 00:00:32,520
Mars

13
00:00:36,410 --> 00:00:34,440

so

14
00:00:38,090 --> 00:00:36,420
it's well accepted that in Mars has

15
00:00:40,729 --> 00:00:38,100
passed there was liquid water on the

16
00:00:42,170 --> 00:00:40,739
surface right so this provides the

17
00:00:44,690 --> 00:00:42,180
potential for there to have been past

18
00:00:46,490 --> 00:00:44,700
microbial life and when we're thinking

19
00:00:48,110 --> 00:00:46,500
about looking for evidence of this past

20
00:00:49,190 --> 00:00:48,120
microbial life a lot of people in this

21
00:00:50,690 --> 00:00:49,200
room

22
00:00:52,790 --> 00:00:50,700
um like to think about

23
00:00:55,970 --> 00:00:52,800
signatures of this microbial life that

24
00:00:58,330 --> 00:00:55,980
are microscopic or molecular but as a

25
00:01:01,189 --> 00:00:58,340
paleontologist I'm more interested in

26
00:01:03,349 --> 00:01:01,199
macroscopic textural signatures that we

27
00:01:06,649 --> 00:01:03,359
can observe in the sedimentological

28
00:01:08,990 --> 00:01:06,659
record from standard imagery right

29
00:01:11,510 --> 00:01:09,000
so to find these types of signatures

30
00:01:13,490 --> 00:01:11,520
that could be useful for the search for

31
00:01:16,550 --> 00:01:13,500
Life on Mars we can turn to the

32
00:01:18,830 --> 00:01:16,560
Precambrian Earth which is a really

33
00:01:21,289 --> 00:01:18,840
useful data set for us to think about

34
00:01:23,149 --> 00:01:21,299
how past microbial life expresses itself

35
00:01:28,429 --> 00:01:23,159
in the sedimentological record because

36
00:01:29,810 --> 00:01:28,439
it is dominated by a record of organic

37
00:01:32,450 --> 00:01:29,820
matte grounds

38
00:01:35,210 --> 00:01:32,460

um during a time when life on Earth was

39
00:01:35,990 --> 00:01:35,220
very simple right

40
00:01:39,230 --> 00:01:36,000
um

41
00:01:41,390 --> 00:01:39,240
and luckily uh these organic backgrounds

42
00:01:44,330 --> 00:01:41,400
formed by a consortia of prokaryotes and

43
00:01:46,190 --> 00:01:44,340
eukaryotes mainly single cellular

44
00:01:48,109 --> 00:01:46,200
um have a significant impact on the

45
00:01:50,090 --> 00:01:48,119
sedimentological record

46
00:01:51,469 --> 00:01:50,100
um we heard earlier today about

47
00:01:54,170 --> 00:01:51,479
something called the extracellular

48
00:01:56,090 --> 00:01:54,180
polymeric substance that microbes

49
00:01:58,249 --> 00:01:56,100
excrete when they are forming a

50
00:02:00,649 --> 00:01:58,259
background that is just kind of this

51
00:02:03,289 --> 00:02:00,659
like sticky substrate and this has an

52
00:02:06,230 --> 00:02:03,299
impact on the sedimentological record in

53
00:02:08,809 --> 00:02:06,240
that it binds baffles and traps sediment

54
00:02:11,029 --> 00:02:08,819
that it is living on and within and thus

55
00:02:13,790 --> 00:02:11,039
prevents erosion and stabilizes sediment

56
00:02:15,229 --> 00:02:13,800
in part this contributes to in carbonate

57
00:02:16,490 --> 00:02:15,239
settings things that you'll probably

58
00:02:18,710 --> 00:02:16,500
you're probably familiar with like

59
00:02:20,930 --> 00:02:18,720
microbialites and stromatolites

60
00:02:22,670 --> 00:02:20,940
but I'm more interested in how this is

61
00:02:24,589 --> 00:02:22,680
expressed in solicit clastic settings

62
00:02:26,869 --> 00:02:24,599
which is broadly applicable to the

63
00:02:29,030 --> 00:02:26,879

Martian geologic environment right and

64
00:02:30,770 --> 00:02:29,040
one way that it can be expressed is in

65
00:02:32,809 --> 00:02:30,780
texture organic surfaces or iterative

66
00:02:34,190 --> 00:02:32,819
Organo sedimentary surface textures I'm

67
00:02:36,110 --> 00:02:34,200
showing you an example of that up here

68
00:02:37,790 --> 00:02:36,120
on the right that's actually a fossil

69
00:02:40,550 --> 00:02:37,800
surface

70
00:02:42,949 --> 00:02:40,560
um and they also impact

71
00:02:46,009 --> 00:02:42,959
um sedimentological packaging in a way

72
00:02:47,390 --> 00:02:46,019
that we can identify and cross-section

73
00:02:49,369 --> 00:02:47,400
so

74
00:02:50,809 --> 00:02:49,379
when I'm talking about kind of these

75
00:02:52,670 --> 00:02:50,819
background bio signatures I think this

76
00:02:54,110 --> 00:02:52,680
brings up a really important question

77
00:02:56,750 --> 00:02:54,120
that I want to kind of frame my whole

78
00:02:58,850 --> 00:02:56,760
talk in in which is that if life ever

79
00:03:00,589 --> 00:02:58,860
existed on Mars was it ever abundant

80
00:03:02,990 --> 00:03:00,599
enough to form organic backgrounds and

81
00:03:04,910 --> 00:03:03,000
impact the sedimentological record on a

82
00:03:06,290 --> 00:03:04,920
macro macroscopic scale like we see in

83
00:03:09,530 --> 00:03:06,300
the Precambrian

84
00:03:10,509 --> 00:03:09,540
and my answer to that is I don't know

85
00:03:12,710 --> 00:03:10,519
um

86
00:03:15,290 --> 00:03:12,720
and the more I think about it the less

87
00:03:17,809 --> 00:03:15,300
I'm convinced that it ever did but this

88
00:03:20,390 --> 00:03:17,819

is still an outstanding question that we

89
00:03:21,890 --> 00:03:20,400
need to think about and there's one way

90
00:03:23,930 --> 00:03:21,900
to find out

91
00:03:26,509 --> 00:03:23,940
um and again this is to Leverage The

92
00:03:29,390 --> 00:03:26,519
pre-kame Brand Rock record so as I

93
00:03:31,850 --> 00:03:29,400
mentioned we have billions of years of

94
00:03:34,550 --> 00:03:31,860
evidence of backgrounds existing in the

95
00:03:36,170 --> 00:03:34,560
pre-cambrian a lot of which is fossil

96
00:03:37,490 --> 00:03:36,180
evidence of maths like what I'm showing

97
00:03:39,229 --> 00:03:37,500
up here on the right

98
00:03:40,789 --> 00:03:39,239
these are not great bio signatures for

99
00:03:42,670 --> 00:03:40,799
the search for Life on Mars because it

100
00:03:46,729 --> 00:03:42,680
to identify them you would need to

101
00:03:48,770 --> 00:03:46,739
excavate betting planes and it also

102
00:03:51,589 --> 00:03:48,780
relies on the fossilization of these

103
00:03:54,649 --> 00:03:51,599
surfaces that

104
00:03:56,149 --> 00:03:54,659
um necessitates a lot of comp like a

105
00:03:57,649 --> 00:03:56,159
suite of complex taphenomic or

106
00:04:00,229 --> 00:03:57,659
preservational processes that are not

107
00:04:02,690 --> 00:04:00,239
guaranteed to have existed on Mars

108
00:04:06,770 --> 00:04:02,700
um so instead I'm interested in looking

109
00:04:08,449 --> 00:04:06,780
at the impacts of backgrounds and that

110
00:04:10,429 --> 00:04:08,459
the extra polymeric substance

111
00:04:11,809 --> 00:04:10,439
extracellular polymeric substance that

112
00:04:15,289 --> 00:04:11,819
they secrete

113
00:04:17,449 --> 00:04:15,299

um on sedimentological packaging

114
00:04:19,310 --> 00:04:17,459
um as it manifests as discrete

115
00:04:21,170 --> 00:04:19,320
sedimentary structures

116
00:04:23,629 --> 00:04:21,180
um that cannot occur in the absence of

117
00:04:26,150 --> 00:04:23,639
biological mediation

118
00:04:27,830 --> 00:04:26,160
so one of these sedimentological

119
00:04:30,710 --> 00:04:27,840
signatures that I'm talking about today

120
00:04:32,510 --> 00:04:30,720
are called Palm says ripples so I'm

121
00:04:33,890 --> 00:04:32,520
showing you images of those here these

122
00:04:36,170 --> 00:04:33,900
are from the milpena edioca national

123
00:04:38,629 --> 00:04:36,180
park in South Australia which was

124
00:04:41,210 --> 00:04:38,639
recently opened as a national park oh my

125
00:04:42,469 --> 00:04:41,220
animations are weird sorry about that

126
00:04:43,850 --> 00:04:42,479
um but if you want to read more about it

127
00:04:45,170 --> 00:04:43,860
it was published

128
00:04:46,850 --> 00:04:45,180
um

129
00:04:49,370 --> 00:04:46,860
a little story about the national park

130
00:04:52,189 --> 00:04:49,380
in NASA astrobiology recently

131
00:04:55,850 --> 00:04:52,199
um but Palm says ripples are defined as

132
00:04:57,890 --> 00:04:55,860
stacks of sandstone bedding planes that

133
00:04:59,930 --> 00:04:57,900
have rippled bottoms and ripple top

134
00:05:01,550 --> 00:04:59,940
surfaces so

135
00:05:03,469 --> 00:05:01,560
we can see if we look at this betting

136
00:05:04,430 --> 00:05:03,479
plane here their ripples preserved on

137
00:05:06,950 --> 00:05:04,440
the top

138
00:05:08,870 --> 00:05:06,960

as well as on the bottom but what does

139
00:05:10,730 --> 00:05:08,880
this mean in terms of like evidence for

140
00:05:12,830 --> 00:05:10,740
life right

141
00:05:14,450 --> 00:05:12,840
um we can look at this figure here to

142
00:05:16,310 --> 00:05:14,460
see kind of the biological processes

143
00:05:19,490 --> 00:05:16,320
behind the formation of these Palm says

144
00:05:21,469 --> 00:05:19,500
ripples so looking at uh section B of

145
00:05:24,170 --> 00:05:21,479
this figure when we think about

146
00:05:26,810 --> 00:05:24,180
pre-cambrian ecosystems microbial mats

147
00:05:28,909 --> 00:05:26,820
were ubiquitous within the world's

148
00:05:31,790 --> 00:05:28,919
oceans covering the sea floor

149
00:05:33,710 --> 00:05:31,800
so when these mats grew on the sea floor

150
00:05:35,510 --> 00:05:33,720
what they would do is stabilize the

151
00:05:39,230 --> 00:05:35,520
rippled surfaces

152
00:05:40,969 --> 00:05:39,240
so when a new depositional event

153
00:05:44,390 --> 00:05:40,979
occurred

154
00:05:46,310 --> 00:05:44,400
the ripples were not eroded

155
00:05:47,990 --> 00:05:46,320
um and are thus cast on the base of the

156
00:05:50,150 --> 00:05:48,000
new depositional event

157
00:05:52,070 --> 00:05:50,160
and then the two betting planes remain

158
00:05:53,629 --> 00:05:52,080
as discrete bed forms that are not

159
00:05:56,629 --> 00:05:53,639
Amalgamated together

160
00:05:58,790 --> 00:05:56,639
so this then

161
00:06:00,409 --> 00:05:58,800
continues as a process resulting in

162
00:06:03,230 --> 00:06:00,419
stacks of these Sandstone bedding planes

163
00:06:07,430 --> 00:06:03,240

with no fine brain inner beds

164
00:06:09,770 --> 00:06:07,440
um and is a definitive signature of past

165
00:06:11,270 --> 00:06:09,780
life that cannot occur in the absence of

166
00:06:12,890 --> 00:06:11,280
biological mediation so this is

167
00:06:14,749 --> 00:06:12,900
potentially a really interesting

168
00:06:15,770 --> 00:06:14,759
biosignature for us to keep in mind when

169
00:06:16,969 --> 00:06:15,780
we're thinking about the search for Life

170
00:06:19,790 --> 00:06:16,979
on Mars

171
00:06:21,770 --> 00:06:19,800
and just you can compare it to kind of

172
00:06:23,749 --> 00:06:21,780
modern processes

173
00:06:25,670 --> 00:06:23,759
um or broadleafana result conditions

174
00:06:27,110 --> 00:06:25,680
where we don't have backgrounds if you

175
00:06:30,230 --> 00:06:27,120
get the deposition of sandstone on

176
00:06:31,730 --> 00:06:30,240
Sandstone the ripples are going to erode

177
00:06:33,350 --> 00:06:31,740
and the betting planes are going to

178
00:06:34,850 --> 00:06:33,360
become Amalgamated resulting in a

179
00:06:36,950 --> 00:06:34,860
cross-section something like this so you

180
00:06:40,010 --> 00:06:36,960
can tell that they're very distinct

181
00:06:43,510 --> 00:06:40,020
um cross-sections one with definitive

182
00:06:45,950 --> 00:06:43,520
evidence of past microbial life

183
00:06:47,870 --> 00:06:45,960
so all in all we can see that Palm says

184
00:06:50,029 --> 00:06:47,880
ripples are

185
00:06:51,290 --> 00:06:50,039
potentially good biosignatures for us to

186
00:06:53,749 --> 00:06:51,300
keep in mind because they cannot be

187
00:06:55,550 --> 00:06:53,759
formed by abiotic processes

188
00:06:56,870 --> 00:06:55,560

and they can occur when and that is very

189
00:06:59,210 --> 00:06:56,880
thin so they can even occur under

190
00:07:01,610 --> 00:06:59,220
biofilm mediation so where it's not

191
00:07:03,469 --> 00:07:01,620
dependent on the presence of eukaryotes

192
00:07:05,510 --> 00:07:03,479
and they're easily identifiable as

193
00:07:07,610 --> 00:07:05,520
macroscopic features in standard imagery

194
00:07:10,370 --> 00:07:07,620
so you don't need a ton of analytical

195
00:07:11,809 --> 00:07:10,380
methods to identify them

196
00:07:14,390 --> 00:07:11,819
but this is not to say there are no

197
00:07:16,129 --> 00:07:14,400
limitations right firstly this is

198
00:07:18,230 --> 00:07:16,139
restricted to rippled Bases you have to

199
00:07:20,089 --> 00:07:18,240
have ripples occurring

200
00:07:21,350 --> 00:07:20,099
um in order for this to be identifiable

201
00:07:23,330 --> 00:07:21,360
and cross-section

202
00:07:26,390 --> 00:07:23,340
but we know these are preserved on Mars

203
00:07:28,189 --> 00:07:26,400
so this doesn't preclude the use of this

204
00:07:29,809 --> 00:07:28,199
feature as a biosignature

205
00:07:32,150 --> 00:07:29,819
and additionally the lithological

206
00:07:35,330 --> 00:07:32,160
criteria is narrow you have to be I be

207
00:07:37,430 --> 00:07:35,340
able to identify the fact that this

208
00:07:39,770 --> 00:07:37,440
cross-section is comprised of only

209
00:07:42,409 --> 00:07:39,780
sandstone and nothing no like Clays or

210
00:07:43,249 --> 00:07:42,419
silts um but again this is an ability we

211
00:07:43,850 --> 00:07:43,259
have

212
00:07:47,930 --> 00:07:43,860
um

213
00:07:50,450 --> 00:07:47,940

to ascertain on the Martian surface so

214
00:07:52,490 --> 00:07:50,460
with this in mind we can kind of think

215
00:07:54,950 --> 00:07:52,500
about well then how would we detect them

216
00:07:56,809 --> 00:07:54,960
right I could go through by hand and

217
00:07:59,749 --> 00:07:56,819
look at all of the images coming out

218
00:08:01,430 --> 00:07:59,759
from the Mars perseverance Rover

219
00:08:02,689 --> 00:08:01,440
um but that's time consuming right so

220
00:08:06,469 --> 00:08:02,699
there's some things we need to consider

221
00:08:07,850 --> 00:08:06,479
in actually using this as a biosignature

222
00:08:09,650 --> 00:08:07,860
um first you know there's a large number

223
00:08:11,330 --> 00:08:09,660
of images

224
00:08:14,390 --> 00:08:11,340
we would ideally like to have rapid

225
00:08:16,430 --> 00:08:14,400
identification of these features like as

226
00:08:17,930 --> 00:08:16,440
the images are taken so we can identify

227
00:08:20,270 --> 00:08:17,940
Target sites of interest for further

228
00:08:22,309 --> 00:08:20,280
analysis because Palm says ripples alone

229
00:08:24,830 --> 00:08:22,319
will not be enough evidence for us to be

230
00:08:26,809 --> 00:08:24,840
like oh there was life

231
00:08:27,950 --> 00:08:26,819
um you would need expertise in

232
00:08:29,510 --> 00:08:27,960
backgrounds and their impact on the

233
00:08:31,070 --> 00:08:29,520
sedimentological record

234
00:08:33,730 --> 00:08:31,080
and of course you want to minimize human

235
00:08:36,589 --> 00:08:33,740
error so with all these caveats in mind

236
00:08:38,570 --> 00:08:36,599
I was kind of thinking you know maybe

237
00:08:39,649 --> 00:08:38,580
the best way for us to approach this

238
00:08:43,010 --> 00:08:39,659

problem

239
00:08:45,650 --> 00:08:43,020
is to use an automated technique to

240
00:08:47,329 --> 00:08:45,660
identify polysest ripples in images of

241
00:08:51,350 --> 00:08:47,339
cross sections

242
00:08:53,690 --> 00:08:51,360
so this is exactly what I did but I am

243
00:08:55,730 --> 00:08:53,700
not an expert in this so I collaborated

244
00:08:58,310 --> 00:08:55,740
with the visualization in intelligent

245
00:09:00,410 --> 00:08:58,320
systems laboratory or viz lab in the

246
00:09:02,810 --> 00:09:00,420
College of Engineering at UCR and worked

247
00:09:05,930 --> 00:09:02,820
with Dr birbanu and Padma John oligata

248
00:09:07,430 --> 00:09:05,940
who did a lot of this work with me

249
00:09:09,949 --> 00:09:07,440
and the first thing I did was show them

250
00:09:12,350 --> 00:09:09,959
my data set from the pre-cambrian

251
00:09:14,990 --> 00:09:12,360
sedimentological record of we had

252
00:09:16,910 --> 00:09:15,000
starting about 200 images of palm cess

253
00:09:20,329 --> 00:09:16,920
ripples because this project was born in

254
00:09:20,990 --> 00:09:20,339
covid and I had no access to the field

255
00:09:22,370 --> 00:09:21,000
um

256
00:09:24,829 --> 00:09:22,380
so we started with this relatively

257
00:09:26,210 --> 00:09:24,839
limited data set and identified caveats

258
00:09:28,730 --> 00:09:26,220
of the data set that the program would

259
00:09:30,889 --> 00:09:28,740
need to overcome including variable

260
00:09:32,630 --> 00:09:30,899
scale of images variable resolution of

261
00:09:34,130 --> 00:09:32,640
images and it would need to have the

262
00:09:35,690 --> 00:09:34,140
ability to account for extraneous

263
00:09:38,329 --> 00:09:35,700

features that are not related to pound

264
00:09:40,490 --> 00:09:38,339
cess ripples like plants fractures Talus

265
00:09:42,769 --> 00:09:40,500
dust and shadows

266
00:09:44,990 --> 00:09:42,779
um and all three of these problems are

267
00:09:48,050 --> 00:09:45,000
problems that we would also have

268
00:09:50,449 --> 00:09:48,060
um in like Mars or images coming from

269
00:09:51,530 --> 00:09:50,459
Mars besides the plants

270
00:09:54,009 --> 00:09:51,540
um

271
00:09:57,470 --> 00:09:54,019
so we started developing this program

272
00:09:59,449 --> 00:09:57,480
and phase one we developed the scene

273
00:10:01,970 --> 00:09:59,459
aware perception augmentation using

274
00:10:03,230 --> 00:10:01,980
composite embedding for segmentation or

275
00:10:04,790 --> 00:10:03,240
space egg

276
00:10:09,230 --> 00:10:04,800
which uses

277
00:10:11,030 --> 00:10:09,240
Cora and sge to identify images

278
00:10:13,910 --> 00:10:11,040
um pounds as ripples in images about

279
00:10:15,530 --> 00:10:13,920
crop so these are just kind of a

280
00:10:17,570 --> 00:10:15,540
schematic of those different different

281
00:10:20,150 --> 00:10:17,580
methodologies if you're interested in

282
00:10:21,350 --> 00:10:20,160
the actual computer vision aspect of it

283
00:10:24,650 --> 00:10:21,360
I encourage you to look at our paper

284
00:10:28,009 --> 00:10:24,660
genre without it at all 2021

285
00:10:30,710 --> 00:10:28,019
and this first past this first pass

286
00:10:33,590 --> 00:10:30,720
their phase one development

287
00:10:35,389 --> 00:10:33,600
um was able to identify policest ripples

288
00:10:37,790 --> 00:10:35,399

in cross-section so we can see in the

289
00:10:39,170 --> 00:10:37,800
pink box that is space egg and it

290
00:10:41,870 --> 00:10:39,180
outperforms other state-of-the-art

291
00:10:45,069 --> 00:10:41,880
techniques for identifying

292
00:10:47,569 --> 00:10:45,079
um planar features in imagery

293
00:10:50,690 --> 00:10:47,579
and identifies Palms as Ripple bed

294
00:10:53,509 --> 00:10:50,700
Junctions with an 89 accuracy rate

295
00:10:55,910 --> 00:10:53,519
but 89 is not that great we thought we

296
00:10:57,590 --> 00:10:55,920
could do more if we had more images so

297
00:11:02,150 --> 00:10:57,600
once covered restrictions lifted a

298
00:11:03,590 --> 00:11:02,160
little bit we took 800 more images to uh

299
00:11:07,009 --> 00:11:03,600
kind of do phase two of this project

300
00:11:10,250 --> 00:11:07,019
wherein we developed SpaceX 2.0

301
00:11:13,069 --> 00:11:10,260
which instead uses used a combination of

302
00:11:17,090 --> 00:11:13,079
Aurora and base net shown here this

303
00:11:21,170 --> 00:11:17,100
paper is currently in review and this

304
00:11:23,750 --> 00:11:21,180
um gave us a 92.32 accuracy so much

305
00:11:26,269 --> 00:11:23,760
improved and again we see that it

306
00:11:29,030 --> 00:11:26,279
outperforms other techniques

307
00:11:31,790 --> 00:11:29,040
as well as our original space egg

308
00:11:33,590 --> 00:11:31,800
so you can see it's much better at

309
00:11:36,530 --> 00:11:33,600
segmenting out the planar features that

310
00:11:39,949 --> 00:11:36,540
we are interested in and like really

311
00:11:41,329 --> 00:11:39,959
concentrating on the regions of Interest

312
00:11:42,889 --> 00:11:41,339
so

313
00:11:46,670 --> 00:11:42,899

to kind of

314
00:11:48,350 --> 00:11:46,680
conclude Palm says ripples are an

315
00:11:50,210 --> 00:11:48,360
important and definitive biosignature

316
00:11:52,610 --> 00:11:50,220
that should be included in Target

317
00:11:54,410 --> 00:11:52,620
structures on Mars and we have developed

318
00:11:57,350 --> 00:11:54,420
a technique for accurately detecting

319
00:11:59,150 --> 00:11:57,360
them using automated methodologies which

320
00:12:00,530 --> 00:11:59,160
is potentially useful for our search for

321
00:12:02,750 --> 00:12:00,540
Life on Mars

322
00:12:04,430 --> 00:12:02,760
um and just to say our next steps this

323
00:12:07,130 --> 00:12:04,440
project is not done our next step is to

324
00:12:09,110 --> 00:12:07,140
develop a classifier where we can feed

325
00:12:10,850 --> 00:12:09,120
through a bulk of images of different

326
00:12:13,009 --> 00:12:10,860
different geologic features it will be

327
00:12:15,170 --> 00:12:13,019
able to sort out between likely pound

328
00:12:18,290 --> 00:12:15,180
says Ripples and non-palm test Ripple

329
00:12:20,449 --> 00:12:18,300
cross sections and then those likely

330
00:12:23,030 --> 00:12:20,459
Palm says Ripple cross sections will be

331
00:12:25,730 --> 00:12:23,040
fed into space egg 2.0 and that will

332
00:12:29,210 --> 00:12:25,740
give us a probability of

333
00:12:30,829 --> 00:12:29,220
um the presence of a pounce Ripples and

334
00:12:33,050 --> 00:12:30,839
we'll also have the ability to classify

335
00:12:33,949 --> 00:12:33,060
morphology and other aspects of these

336
00:12:38,269 --> 00:12:33,959
features

337
00:12:40,370 --> 00:12:38,279
so with that I would like to thank

338
00:12:41,990 --> 00:12:40,380

um on my funding sources as well as

339
00:12:44,449 --> 00:12:42,000
everyone who contributed to this product

340
00:12:46,430 --> 00:12:44,459
project through taking imagery of ground

341
00:12:48,230 --> 00:12:46,440
truth thing and I would like to thank

342
00:12:50,509 --> 00:12:48,240
Ross and June Fargo for access to the

343
00:12:52,670 --> 00:12:50,519
milpinia national park on their property

344
00:12:55,129 --> 00:12:52,680
and acknowledge that this land lies

345
00:12:57,650 --> 00:12:55,139
within the traditional lands and again

346
00:12:58,920 --> 00:12:57,660
there's a QR code for the life RCN

347
00:13:02,810 --> 00:12:58,930
thanks

348
00:13:07,009 --> 00:13:04,550
happy

349
00:13:08,389 --> 00:13:07,019
okay fantastic Rachel do we have any

350
00:13:13,670 --> 00:13:08,399
questions

351
00:13:17,930 --> 00:13:15,650
uh I was wondering first of all thank

352
00:13:20,329 --> 00:13:17,940
you for a great talk uh I was wondering

353
00:13:22,910 --> 00:13:20,339
does anything about those Ripples and

354
00:13:24,590 --> 00:13:22,920
texture or any other factors change

355
00:13:26,329 --> 00:13:24,600
um over the course of percambrian so

356
00:13:28,250 --> 00:13:26,339
like connect are there any connections

357
00:13:30,829 --> 00:13:28,260
like major events like oxygenation or

358
00:13:33,410 --> 00:13:30,839
other things and if so like can we infer

359
00:13:35,569 --> 00:13:33,420
anything can we infer any like make any

360
00:13:37,430 --> 00:13:35,579
past climate inferences for something

361
00:13:40,449 --> 00:13:37,440
like Mars this is a really good question

362
00:13:44,870 --> 00:13:40,459
and talk to me after I finish my postdoc

363
00:13:44,880 --> 00:13:53,750

anyone else

364
00:13:57,829 --> 00:13:55,670
so I'm wondering if there's any images

365
00:14:00,230 --> 00:13:57,839
from Mars that this can be applied to

366
00:14:02,269 --> 00:14:00,240
now or we just have to reorient the

367
00:14:03,650 --> 00:14:02,279
cameras to sort of start doing that

368
00:14:05,750 --> 00:14:03,660
there are definitely images that this

369
00:14:07,310 --> 00:14:05,760
can be applied to it like that's kind of

370
00:14:09,889 --> 00:14:07,320
why I'm like harping on this

371
00:14:11,150 --> 00:14:09,899
biosignature because it's a like most of

372
00:14:14,870 --> 00:14:11,160
our imagery we're getting is of

373
00:14:17,569 --> 00:14:14,880
cross-sections from the Martian surface

374
00:14:18,769 --> 00:14:17,579
um so yeah where once we have the

375
00:14:20,629 --> 00:14:18,779
classifier we're going to start running

376
00:14:22,430 --> 00:14:20,639
them through from what I've seen just

377
00:14:23,389 --> 00:14:22,440
like looking at them I don't see

378
00:14:25,550 --> 00:14:23,399
anything

379
00:14:30,350 --> 00:14:25,560
um that would look like it but it's an

380
00:14:35,150 --> 00:14:33,110
I I was just wondering uh wondering if

381
00:14:37,250 --> 00:14:35,160
you guys were using any kind of like uh

382
00:14:39,350 --> 00:14:37,260
like depth data for this because it

383
00:14:41,689 --> 00:14:39,360
feels like these uh sort of in the

384
00:14:44,090 --> 00:14:41,699
images that looked very quite 3D and you

385
00:14:46,850 --> 00:14:44,100
know if you have like two images yeah so

386
00:14:49,550 --> 00:14:46,860
we did we did um take that into

387
00:14:51,650 --> 00:14:49,560
consideration kind of looking at the the

388
00:14:53,210 --> 00:14:51,660

depth of the images and it didn't really

389
00:14:54,829 --> 00:14:53,220
change

390
00:14:56,930 --> 00:14:54,839
um kind of the performance of the

391
00:14:59,569 --> 00:14:56,940
program so I believe it's incorporated

392
00:15:02,750 --> 00:14:59,579
into it but it's not a huge aspect of it

393
00:15:06,290 --> 00:15:04,310
okay we're going to take one more over

394
00:15:13,370 --> 00:15:06,300
here oh Mike is itching to ask a

395
00:15:17,090 --> 00:15:15,829
hi interesting talk kind of similar um

396
00:15:19,129 --> 00:15:17,100
have you ever thought about applying

397
00:15:22,430 --> 00:15:19,139
this to like maybe like

398
00:15:24,889 --> 00:15:22,440
um debated diagnostic like bio faces

399
00:15:29,030 --> 00:15:24,899
that are in the fossil record like um

400
00:15:32,509 --> 00:15:31,970
I'm not quite clear on what you're like

401
00:15:34,189 --> 00:15:32,519
um

402
00:15:36,590 --> 00:15:34,199
just similar like at least other like

403
00:15:39,050 --> 00:15:36,600
stromatilator microbial systems that

404
00:15:41,090 --> 00:15:39,060
like have debated like um sources yeah

405
00:15:41,870 --> 00:15:41,100
that's a really interesting question

406
00:15:44,269 --> 00:15:41,880
um

407
00:15:47,750 --> 00:15:44,279
no so this is like specifically

408
00:15:49,490 --> 00:15:47,760
developed just for like this one feature

409
00:15:52,250 --> 00:15:49,500
um I think it is work that other people

410
00:15:54,769 --> 00:15:52,260
are doing that are not me

411
00:15:56,930 --> 00:15:54,779
um but yeah there's definitely other

412
00:15:58,430 --> 00:15:56,940
like computer vision programs that have

413
00:15:59,389 --> 00:15:58,440

been developed to identify similar

414
00:16:02,629 --> 00:15:59,399
features

415
00:16:06,050 --> 00:16:04,550
all right we're gonna let Mike ask a

416
00:16:11,389 --> 00:16:06,060
question he's been working hard for us

417
00:16:16,370 --> 00:16:14,030
this is actually my question not online

418
00:16:17,810 --> 00:16:16,380
um I'm just curious uh if you did see

419
00:16:19,310 --> 00:16:17,820
something on Mars what would you need to

420
00:16:20,689 --> 00:16:19,320
actually confirm that could you do it

421
00:16:22,370 --> 00:16:20,699
visually or would you need sample return

422
00:16:24,230 --> 00:16:22,380
or

423
00:16:25,910 --> 00:16:24,240
yeah that's a really good question I'm

424
00:16:28,970 --> 00:16:25,920
from my perspective I think it's like a

425
00:16:31,730 --> 00:16:28,980
first pass ID I think like

426
00:16:34,069 --> 00:16:31,740
there's it is a definitive bio signature

427
00:16:37,129 --> 00:16:34,079
but I wouldn't never want to just like

428
00:16:39,370 --> 00:16:37,139
say oh space egg 2.0 said there's like a

429
00:16:41,269 --> 00:16:39,380
99 chance and that's definitive evidence

430
00:16:44,470 --> 00:16:41,279
I think

431
00:16:46,910 --> 00:16:44,480
um yeah sample return or like further

432
00:16:49,910 --> 00:16:46,920
analysis of

433
00:16:52,120 --> 00:16:49,920
um that section would be needed to like

434
00:16:58,430 --> 00:16:52,130
really definitively say anything