

Radio Meteor Zoo, a Zooniverse project

ZOONIVERSE



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Presentation outline

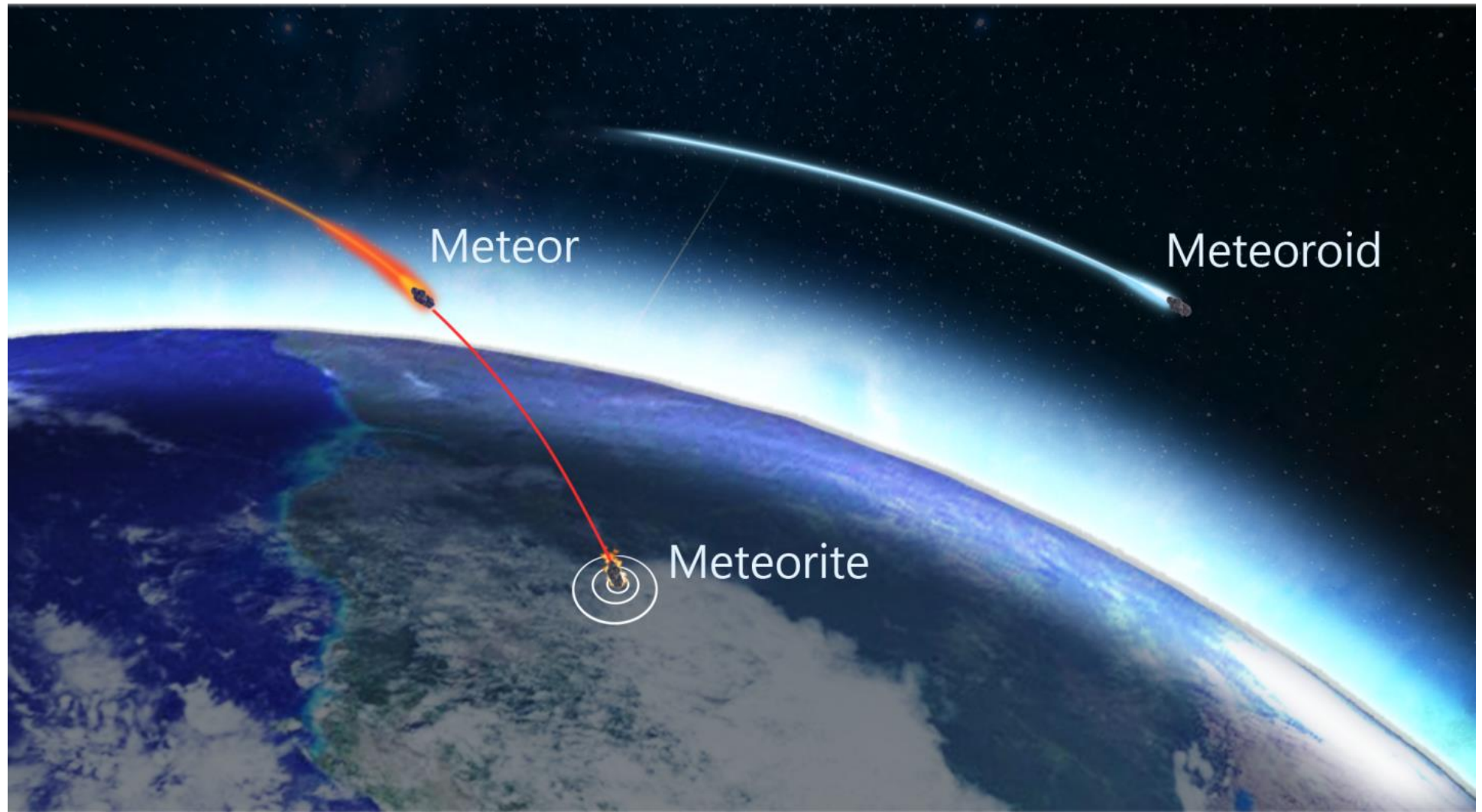
- Introduction to radio meteor research
- How do citizen scientists help us?
- How will machine learning support the Radio Meteor Zoo?



BRIEF INTRODUCTION TO RADIO METEOR RESEARCH



What is a meteor?





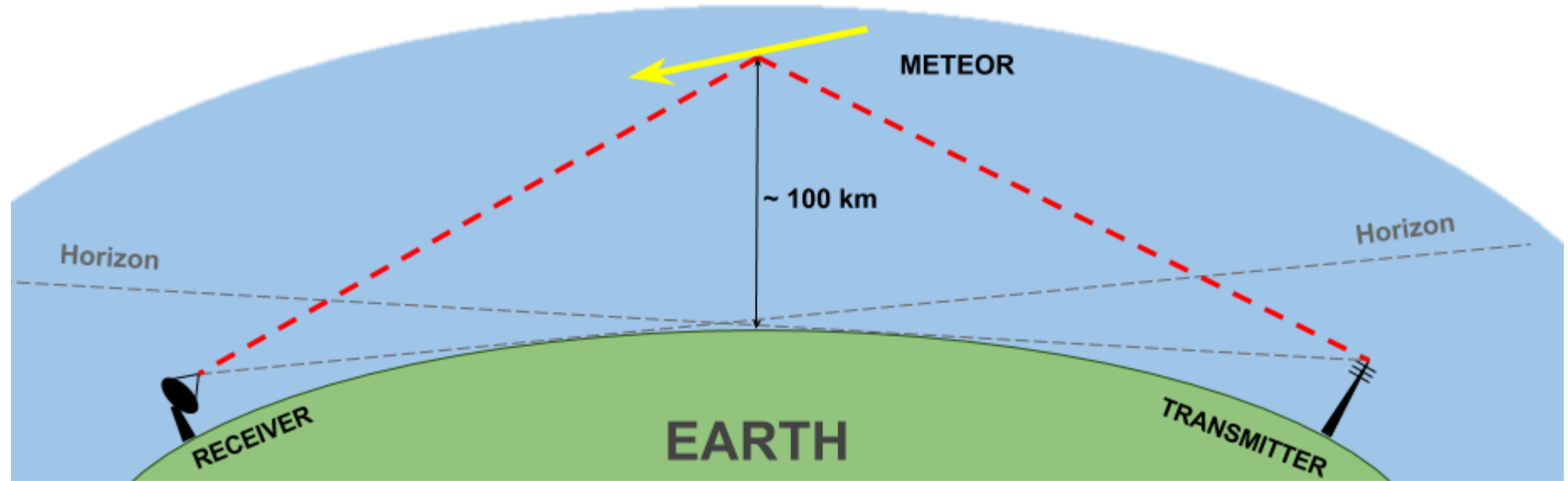
Bright meteor above Belgium/France





We observe meteors using radio techniques

Radio meteors don't emit radio waves, but the ionized trail behind the meteoroid reflects them.

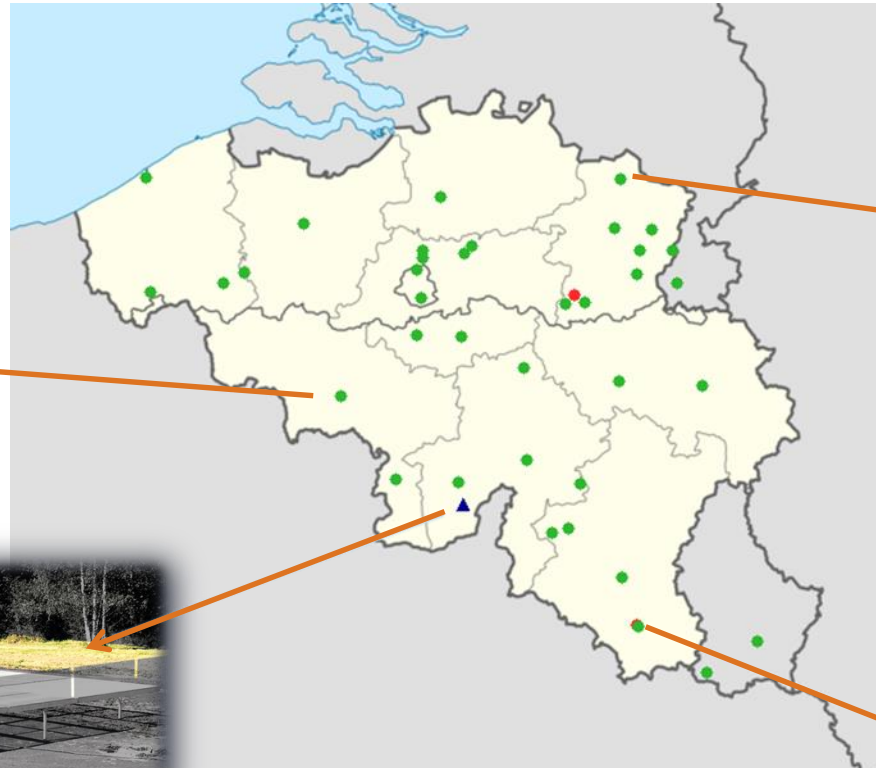




The BRAMS network



Namur



Overpelt



Dedicated transmitter
in Dourbes



Neufchâteau



Goals of the BRAMS project

- **Automatic detection** of meteor echoes
- To compute **meteoroid flux densities** and **mass indexes**
- To determine **individual meteor trajectories** from observations of the same meteor by multiple stations
- To determine **orbital parameters** of multi-station meteoroids
- To analyze meteor profiles in order to retrieve physical parameters such as **ionization, speed and mass** of the meteoroids

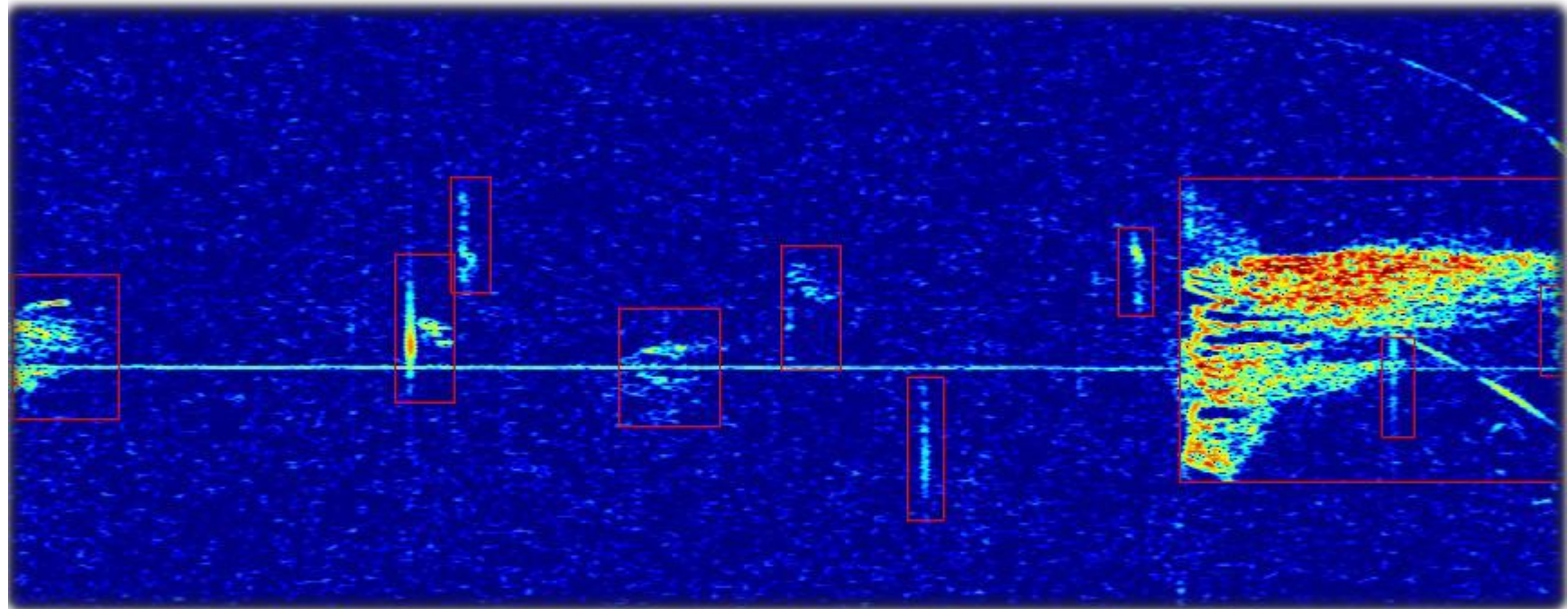


HOW DO CITIZEN SCIENTISTS HELP US?



Detection of meteor echoes

- Every five minutes, each station produces a spectrogram.
- So we collect more than 10,000 spectrograms per day
- We need ways to detect meteors automatically







The Radio Meteor Zoo

RADIO METEOR ZOO ABOUT CLASSIFY TALK COLLECT PROJECT WEBSITE FEEDBACK

Draw a rectangle around each potential meteor echo.

rectangle tool 1 drawn

Need some help with this task?

Done & Talk Done

Show the project tutorial

You should sign in!



HOW WILL MACHINE LEARNING SUPPORT THE RADIO METEOR ZOO?

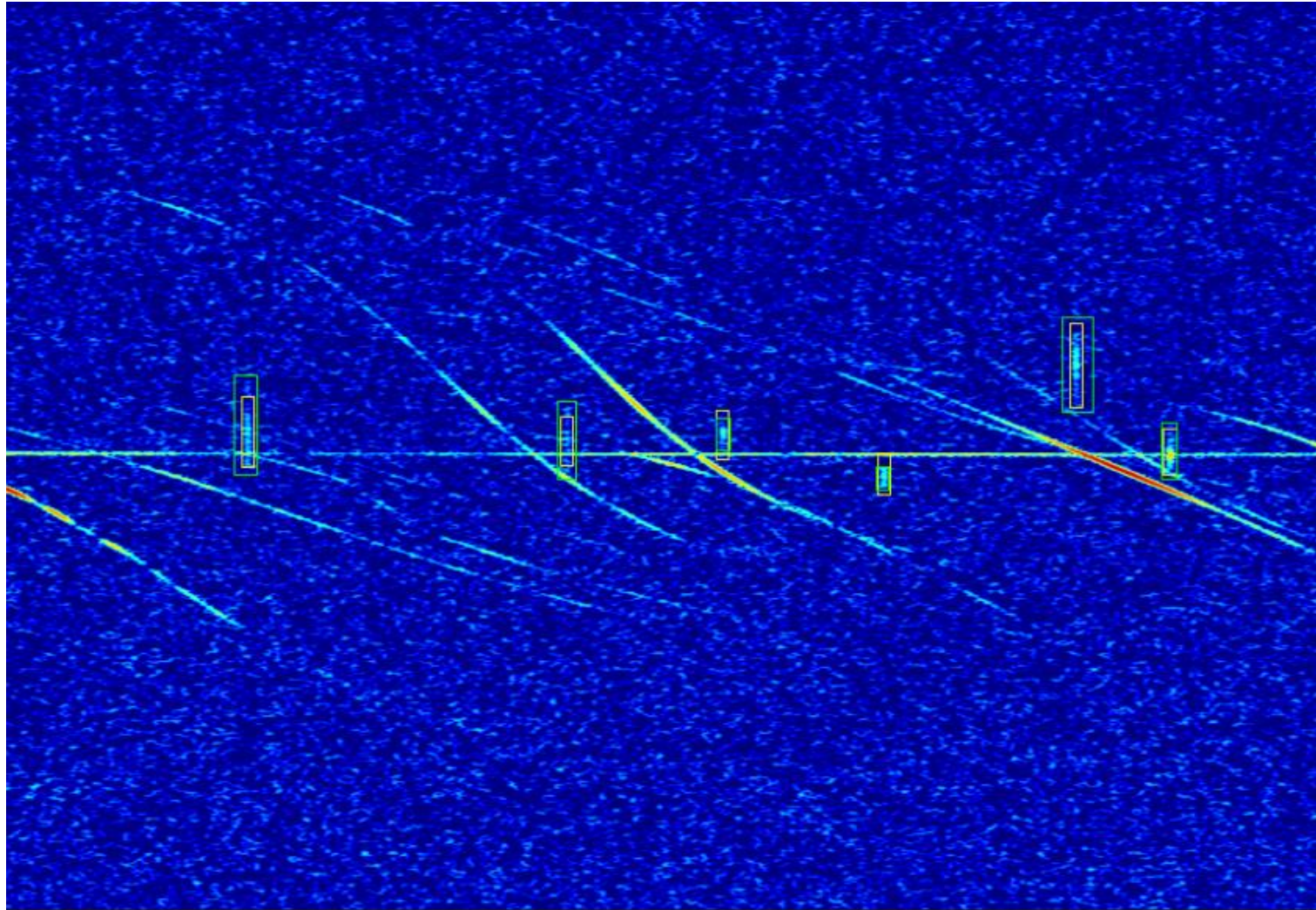


The Radio Meteor Zoo 2.0

- **Goal:** improve volunteers' satisfaction & classification quality
- Volunteers check/correct the classifications made by a ML algorithm
- Gamification elements

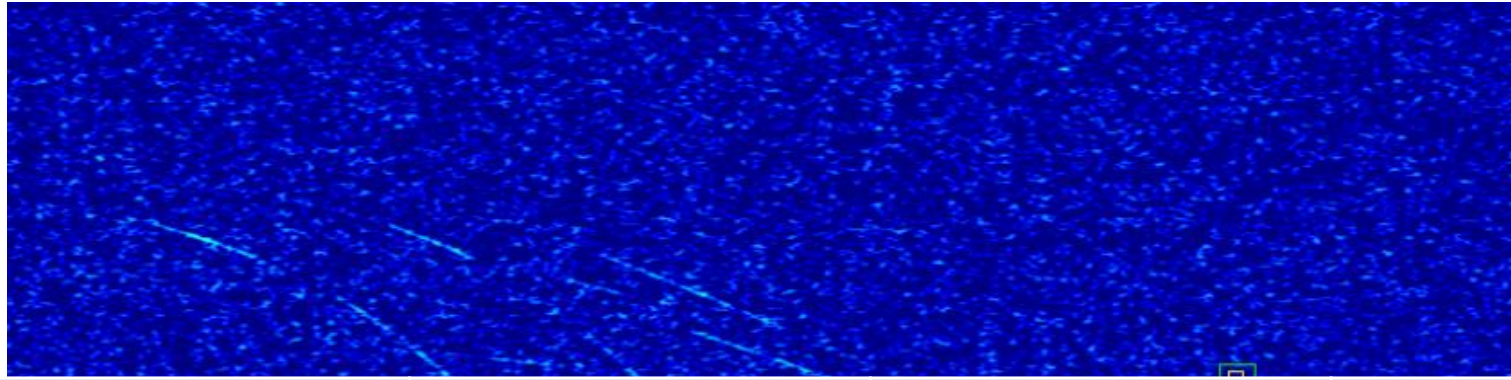


First tests with CNN

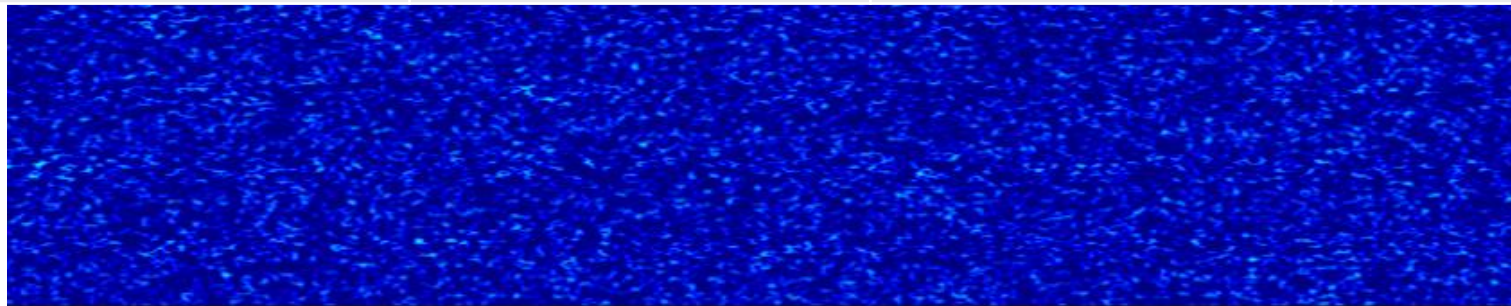




First tests with CNN



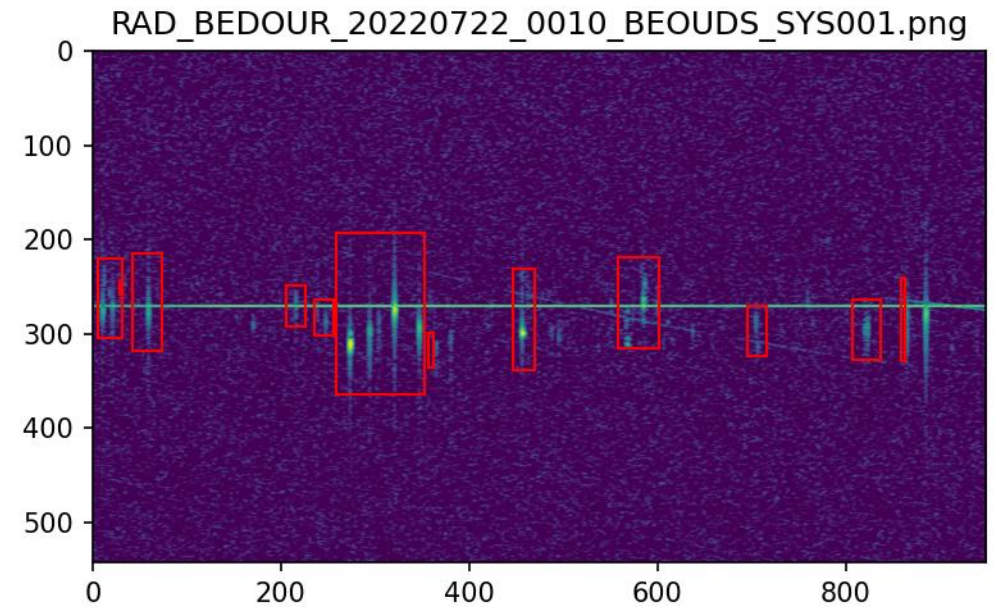
	Draulans	Lobet SimpleCNN	Lobet TransposedCNN	Lobet DilatedCNN
precision	0.852	0.831	0.755	0.861
recall	0.676	0.820	0.873	0.879
F1	0.754	0.826	0.810	0.870





Cleaning training data

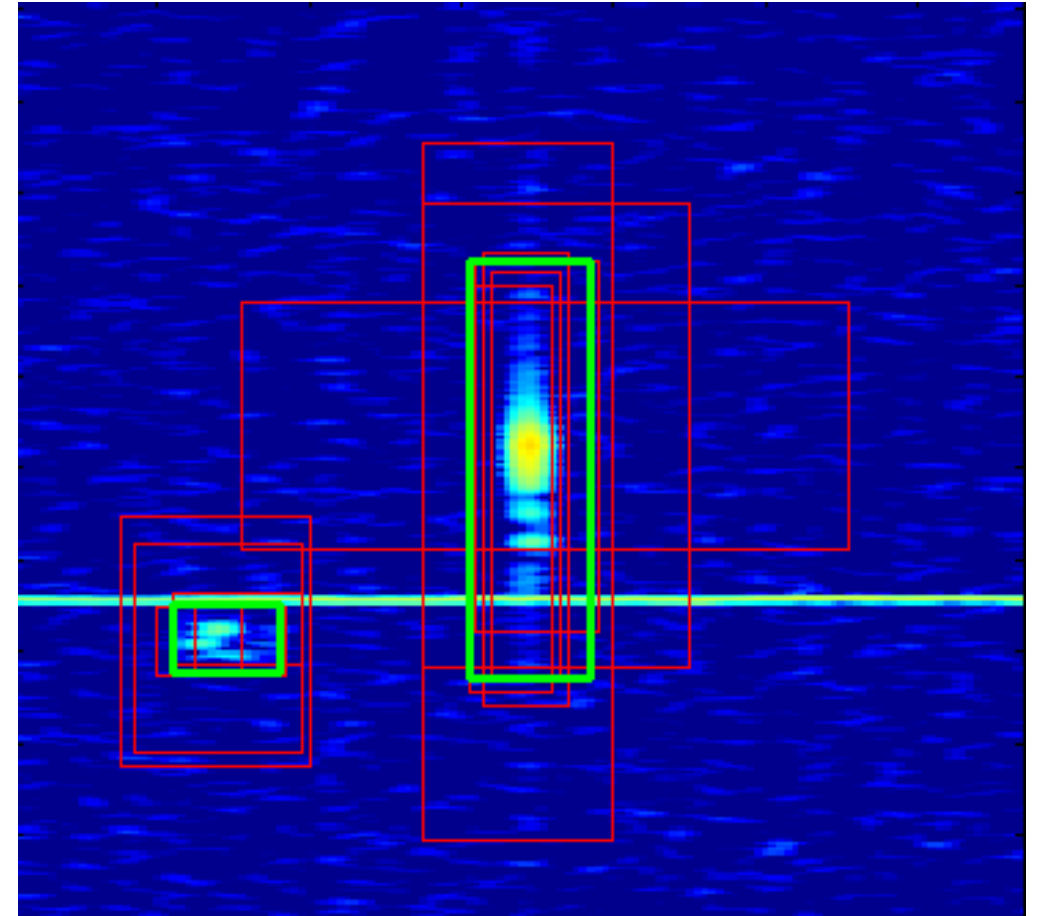
- Improve aggregation algorithm





Cleaning training data

- Improve aggregation algorithm
- User score





Conclusion

- BRAMS is a network of radio receivers to detect meteors
- Especially during meteor showers, it is difficult to detect these meteors automatically
- Therefore we launched the Radio Meteor Zoo, where we ask citizen scientists to classify meteors in spectrograms
- We are now looking into using Machine Learning techniques to learn from the RMZ examples



THANK YOU!
MORE INFO?

<https://www.radiometeorzoo.be>
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