grand-challenge.org

October 25, 2022

Bram van Ginneken, Kiran Vaidhya Venkadesh, Anindo Saha

Radboud University Medical Center, Nijmegen, The Netherlands

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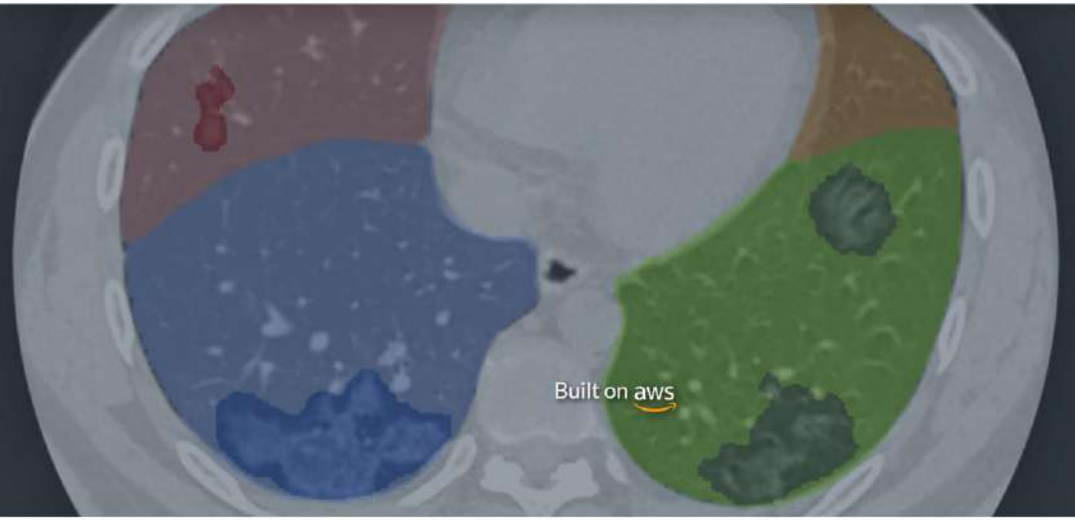
Grand Challenge

A platform for end-to-end development of machine learning solutions in biomedical imaging.

74,000+ users 331 challenges 2,024 algorithms



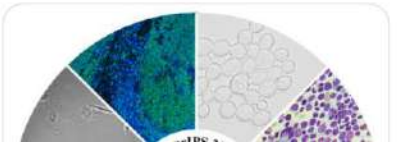
MICCAI

How to run a challenge? MICCAI webinar on Oct 25th 2022

The MICCAI Special Interest Group (SIG) for Challenges is hosting a webinar on How to run a challenge? on Oct 25th, 2022 at 1 pm GMT. Bram van Ginneken, Kiran Vaidhya Venkadesh, and Anindo Saha will present how to use Grand Challenge for organizing high-profile challenges. Jake Albrecht from Sage will present tips for challenge organizers on how to...

FEATURED CHALLENGES

Participate in a challenge | Organize your own challenge

Problem

- Researcher develops an algorithm that takes a medical image as input (e.g., an abdomen CT scan) and produces some output (e.g., a liver segmentation)
- Researcher shows results on some locally collected test cases, reports some metrics (e.g., Dice scores) and maybe compares scores to scores reported in other papers that address the same task
- But these numbers are not really comparable…

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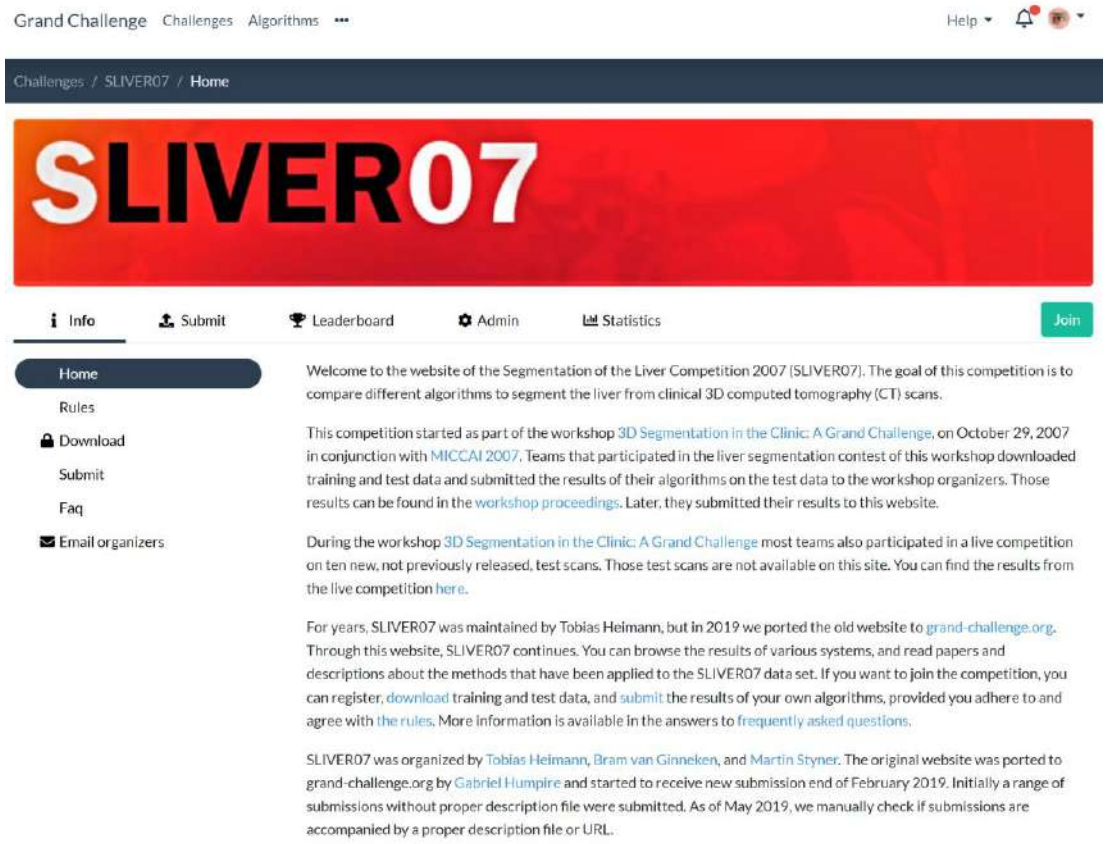
Solution

- Organize a challenge!
- Invite all researchers in the world with an algorithm for the same task to participate
- Fair comparison



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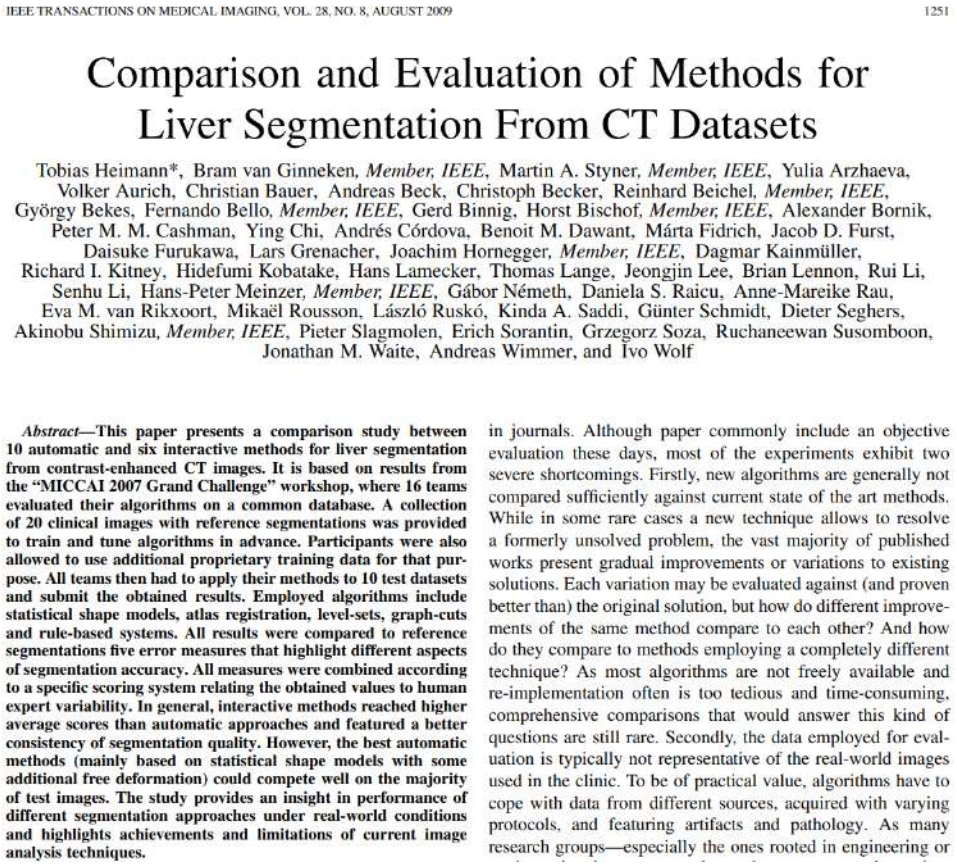
- Fair comparison and a nice review of the SOTA



IEEE TRANSACTIONS ON MEDICAL IMAGING, VOL. 28, NO. 8, AUGUST 2009 1251

Comparison and Evaluation of Methods for Liver Segmentation From CT Datasets

Tobias Heimann*, Bram van Ginneken, *Member, IEEE*, Martin A. Styner, *Member, IEEE*, Yulia Arzhaeva, Volker Aurich, Christian Bauer, Andreas Beck, Christoph Becker, Reinhard Beichel, *Member, IEEE*, György Bekes, Fernando Bello, *Member, IEEE*, Gerd Binnig, Horst Bischof, *Member, IEEE*, Alexander Bornik, Peter M. M. Cashman, Ying Chi, Andrés Córdova, Benoit M. Dawant, Márta Fidrich, Jacob D. Furst, Daisuke Furukawa, Lars Grenacher, Joachim Hornegger, *Member, IEEE*, Dagmar Kainmüller, Richard I. Kitney, Hidefumi Kobatake, Hans Lamecker, Thomas Lange, Jeongjin Lee, Brian Lennon, Rui Li, Senhu Li, Hans-Peter Meinzer, *Member, IEEE*, Gábor Németh, Daniela S. Raicu, Anne-Mareike Rau, Eva M. van Rikxoort, Mikaël Rousson, László Ruskó, Kinda A. Saddi, Günter Schmidt, Dieter Seghers, Akinobu Shimizu, *Member, IEEE*, Pieter Slagmolen, Erich Sorantin, Grzegorz Soza, Ruchaneewan Susomboon, Jonathan M. Waite, Andreas Wimmer, and Ivo Wolf

***Abstract*—This paper presents a comparison study between 10 automatic and six interactive methods for liver segmentation from contrast-enhanced CT images. It is based on results from the "MICCAI 2007 Grand Challenge" workshop, where 16 teams evaluated their algorithms on a common database. A collection of 20 clinical images with reference segmentations was provided to train and tune algorithms in advance. Participants were also allowed to use additional proprietary training data for that purpose. All teams then had to apply their methods to 10 test datasets and submit the obtained results. Employed algorithms include statistical shape models, atlas registration, level-sets, graph-cuts and rule-based systems. All results were compared to reference segmentations five error measures that highlight different aspects of segmentation accuracy. All measures were combined according to a specific scoring system relating the obtained values to human expert variability. In general, interactive methods reached higher average scores than automatic approaches and featured a better consistency of segmentation quality. However, the best automatic methods (mainly based on statistical shape models with some additional free deformation) could compete well on the majority of test images. The study provides an insight in performance of different segmentation approaches under real-world conditions and highlights achievements and limitations of current image analysis techniques.**

in journals. Although paper commonly include an objective evaluation these days, most of the experiments exhibit two severe shortcomings. Firstly, new algorithms are generally not compared sufficiently against current state of the art methods. While in some rare cases a new technique allows to resolve a formerly unsolved problem, the vast majority of published works present gradual improvements or variations to existing solutions. Each variation may be evaluated against (and proven better than) the original solution, but how do different improvements of the same method compare to each other? And how do they compare to methods employing a completely different technique? As most algorithms are not freely available and re-implementation often is too tedious and time-consuming, comprehensive comparisons that would answer this kind of questions are still rare. Secondly, the data employed for evaluation is typically not representative of the real-world images used in the clinic. To be of practical value, algorithms have to cope with data from different sources, acquired with varying protocols, and featuring artifacts and pathology. As many research groups—especially the ones rooted in engineering or

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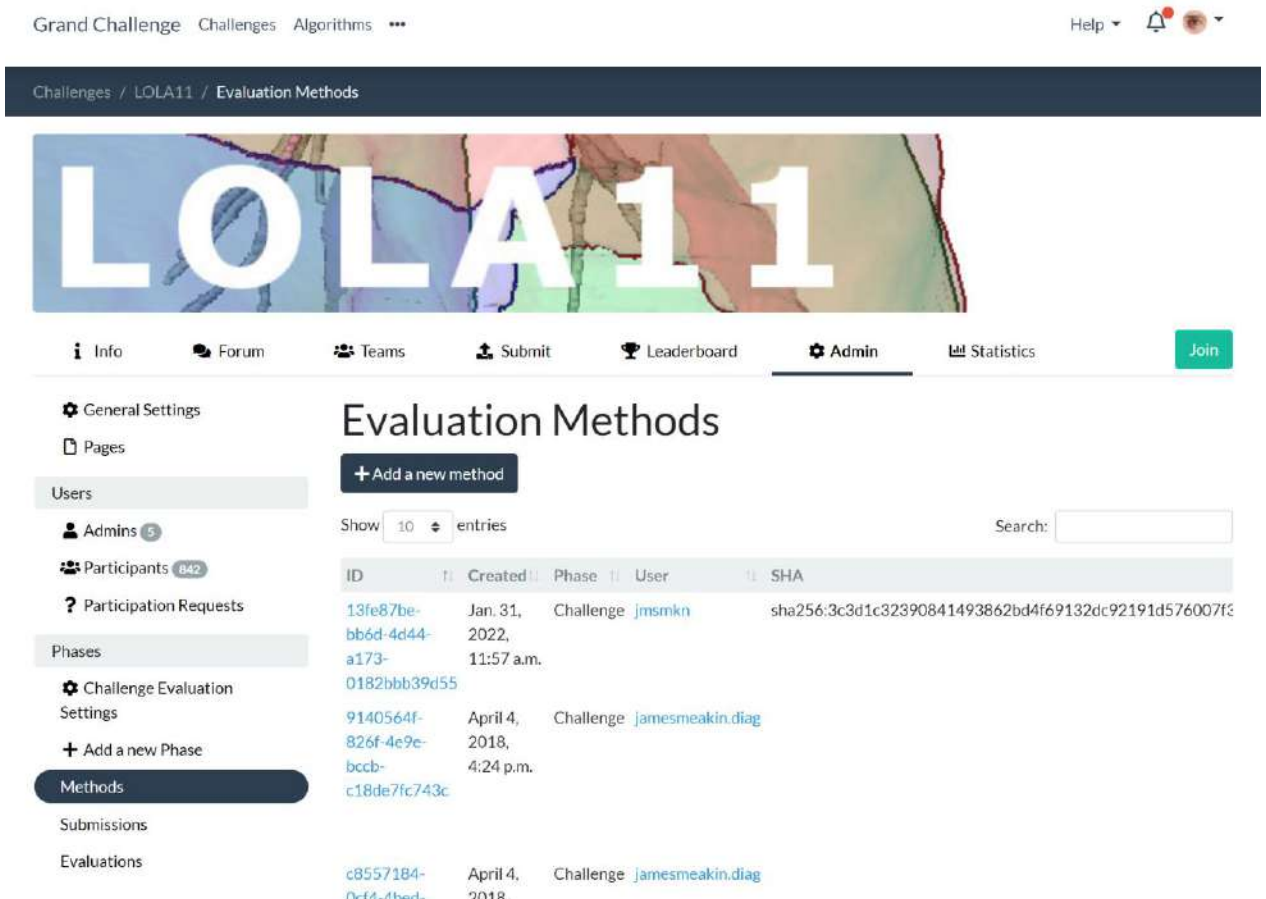
Solution

- Use grand-challenge.org
- Implement what happens when a participating team uploads a result in a container
- The challenge can run forever!



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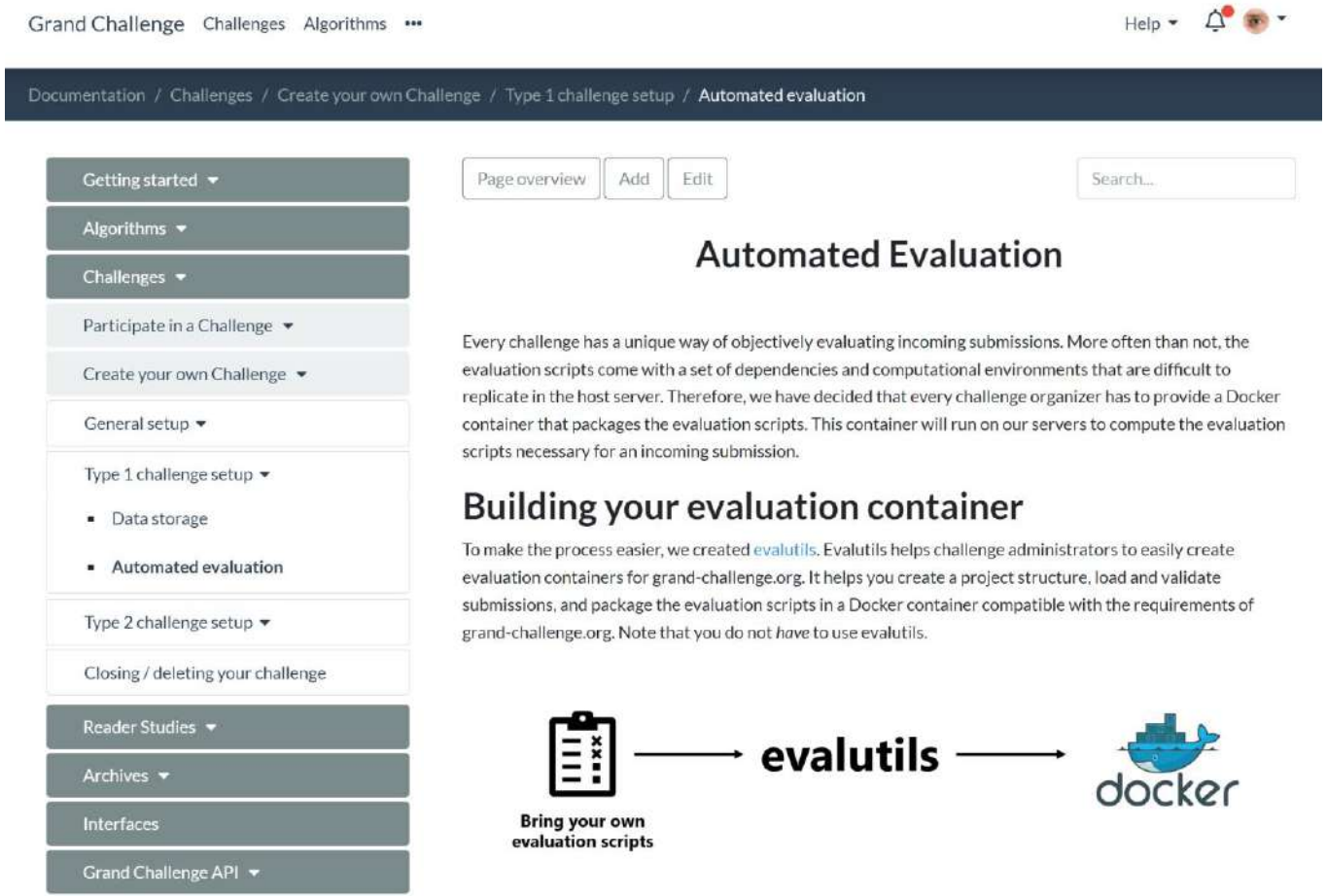

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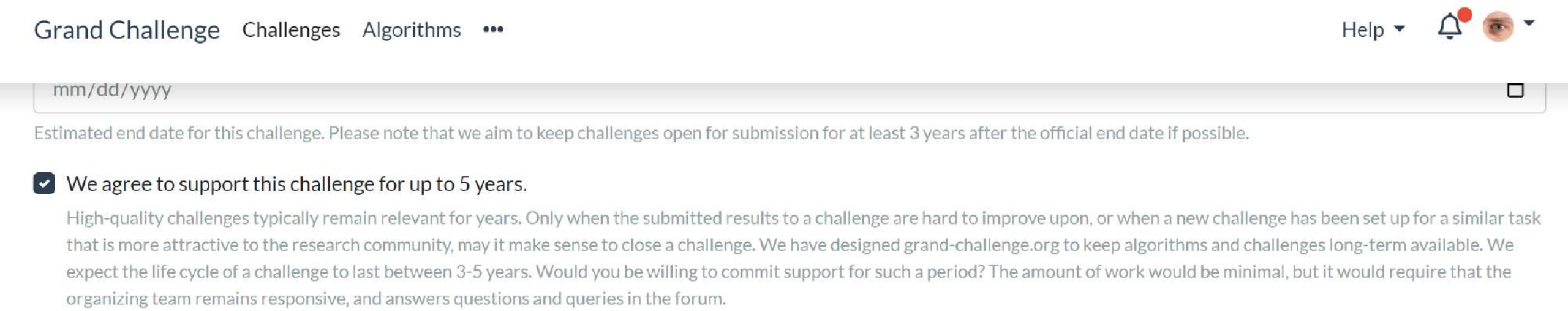

Problem

- My challenge was a huge success
- The top entries on the leaderboard are great solutions
- So many researchers, and even clinicians, would like to use those solutions
- But they can’t. They tried to contact the developers of the top entries but got no reply
- Now they are emailing me, the challenge organizer, but I have to explain them these are not my algorithms
- Some of the top teams released their code, but I can’t compile it…

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- Participants upload a container image of their algorithm; this algorithm is directly available on grand-challenge.org

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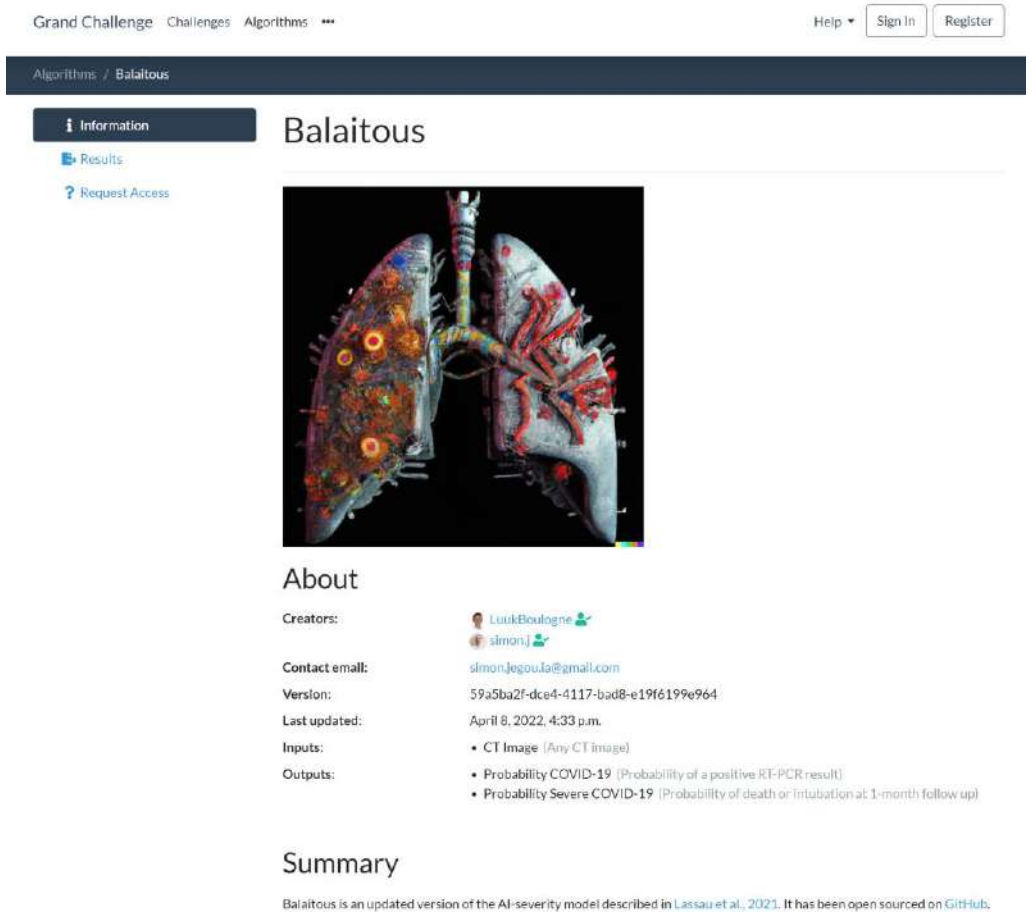

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Problem

- I can’t share my test data
- My participants cheat, they let a radiologist label the test data

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Solution

- Type 3 challenges on grand-challenge.org
- Participants upload a container image of their training code; this code is trained with secret training data and produces an Algorithm directly available on grand-challenge.org

Type	Training data & labels	Test data	Test labels	Participant's Artefact	Provided by Challenge Creators
0	Open	Open	Open	Metrics	
1	Open	Open	Closed	Predictions	Evaluation Method
2	Open	Closed	Closed	Inference Algorithm	+ Test data
3	Closed	Closed	Closed	Training Algorithm	+ Training data

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MIDL - Medical Imaging with De

midl.io

Medical Imaging with Deep Learning

Medical Imaging with Deep Learning (MIDL) brings the community of deep learning and medical imaging researchers, clinicians and health-care companies together for in-depth discussion and exchange of ideas. To learn more about MIDL, read our aims and scope and visit the conference sites listed above and below.

MIDL is organized by the MIDL Foundation and its Board.

MIDL is inviting proposals to organize **MIDL challenges**.

We are soliciting bids to organize **MIDL 2024 (deadline to submit a bid Nov. 30 2022)** and MIDL 2025.

Call for challenges | Call for MIDL 2024 | Call for MIDL 2025

Past editions

Past events

Call for challenges | MIDL

midl.io/call-for-challenges.html

Medical Imaging with Deep Learning

Call for challenges

Challenges have become an essential part of research in medical imaging. Challenges pose a problem and solicit solutions from participants all over the world; each solution is validated on the same test data, making for a fair comparison. Following MIDL's commitment to openness and transparency, hosting regular, high-quality challenges is a logical next step towards creating an active scientific community in the "midl" of methodological novelty and clinical impact.

MIDL is now soliciting proposals for medical image analysis challenges. We want to support several challenges every year. We will integrate these events with MIDL activities such as our online events and the yearly MIDL conference.

We aim to improve the quality of challenges and encourage the adoption of new elements in challenges that will make them more reproducible and make their output - the solutions that solve the task at hand in an efficient and effective manner — more reusable, for the research community, and for clinical end-users.

We have decided to partner with grand-challenge.org because this platform already offers many of the features that would make future challenges more reproducible, open and reusable. The platform grand-challenge.org and the MIDL challenges are supported by Amazon Web Services.

How to submit?

Requests for organizing MIDL challenges can be submitted continuously and will be processed on a rolling basis. To submit your application, follow this link. Make sure to indicate that the *Affiliated event* is MIDL, and make sure to include the Structured challenge submission form on the Structured Chalenge Submission System site.

What do you get from us?

If your challenge is selected as a MIDL challenge:

- You will be able to host the challenge for free on grand-challenge.org and all costs for storing the algorithms that participants upload to compete in the challenge and for processing the test data are waived.
- MIDL and grand-challenge.org will advise the organizing team and provide support for data collection and data annotation. The organizing team will have a point of contact from the MIDL Board.
- We will provide participants free access to large training data sets via the AWS Open Data Registry, and we will use Zenodo for making smaller data sets available.
- The best solutions to challenges will remain available as Algorithms on grand-challenge.org and can be accessed by any registered user of the platform to process new data and use this for research and development;
- Challenge organizers can provide free participation to the yearly MIDL conference for team members of top contenders;
- We may be able to provide prizes to the best performing team in the form of AWS credits;
- There will be a new Challenge Paper Track at the MIDL conference for papers relating to MIDL challenges. We expect this will attract more participants to your challenge. The deadlines and review process for this Challenge Paper track will be the same as for the Short Papers and will have a high acceptance rate;
- Organizers are invited to present their challenge and its results at the MIDL conference;

What does grand-challenge.org provide?

	Wiki – to create a site, add, and edit pages
	User management – registration, teams, forums

What does grand-challenge.org provide?

	Wiki – to create a site, add, and edit pages
	User management – registration, teams, forums
	Secure ways to host challenge data

Store your hidden test data as a private archive

https://grand-challenge.org/archives

- **Input data – private Archive** on grand-challenge.org
- **Labels – should not be added to the Archive**, you do not want participating algorithms to access the ground truth

Archives

An archive can be used to collect set of medical images, which can later be used in a reader study, challenge or algorithm. Please contact us if you would like to set up your own archive.

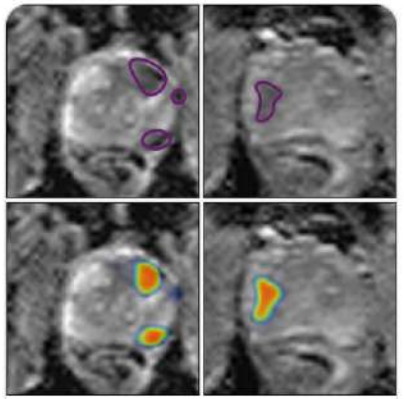
+ New Archive

Filter Archives | ✕ Remove Filters

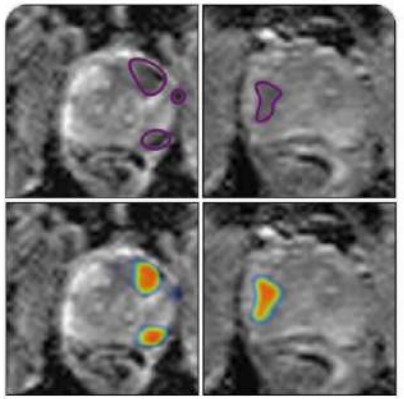
Filters included 4 of 66 total archives

PI-CAI Testing Dataset 🔒
PI-CAI Testing Dataset for both Open Development Phase and Closed Testing Phase

PI-CAI Open Development Phase - Validation and Tuning Dataset 🔒
PI-CAI Open Development Phase - Validation and Tuning Dataset



Tryout Archive PI-CAI 🔒
Tryout Archive to test algorithm submissions to the PI-CAI T2 phases



Dummy Archive PI-CAI 🔒
Dummy archive to test T2 algorithm submission to PI-CAI

Information
Editors
Uploaders
Users
Requests 0
Add Items
View Images
View Items
Add to Reader Study
Export

DLCST size-matched set

Admin Info

Only users that you add to the users group will be able to view this archive. This archive uses CIRRUS Core with configuration Chest CT.

Update Settings

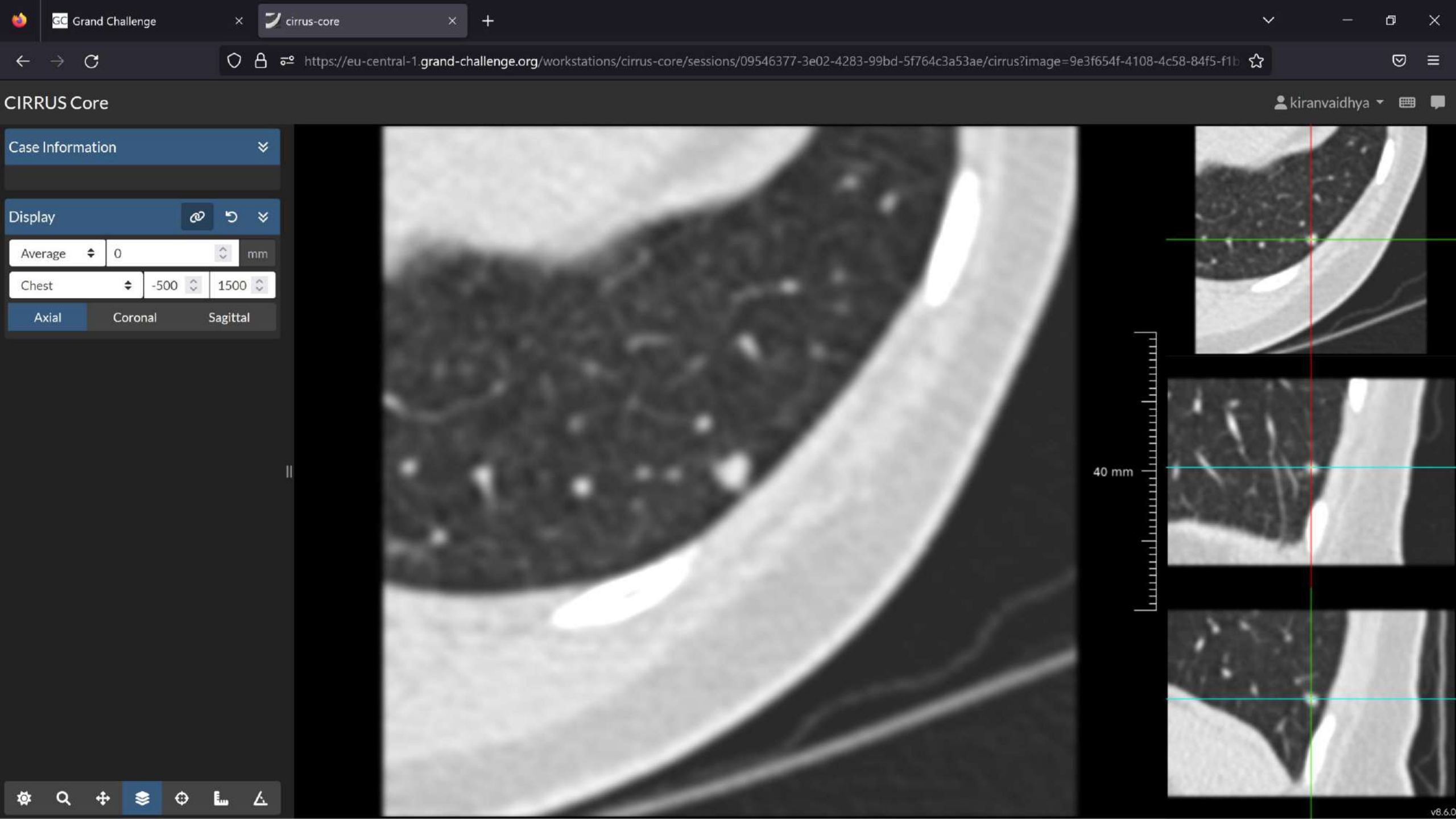
Information
Editors
Uploaders
Users
Requests 0
Add Items
View Images
View Items
Add to Reader Study
Export

Editors

The following users are able to edit, view all items, download all items and upload new items to this archive:

kiranvaidhya

+ Add Editors


Grand Challenge
cirrus-core
https://eu-central-1.grand-challenge.org/workstations/cirrus-core/sessions/09546377-3e02-4283-99bd-5f764c3a53ae/cirrus?image=9e3f654f-4108-4c58-84f5-f1b
CIRRUS Core
kiranvaidhya
Case Information
Display
Average
0
mm
Chest
-500
1500
Axial
Coronal
Sagittal
40 mm
v8.6.0

Algorithms – necessary for Type 2 challenges

	Wiki – to create a site, add, and edit pages
	User management – registration, teams, forums
	Secure ways to host challenge data, **and algorithms**

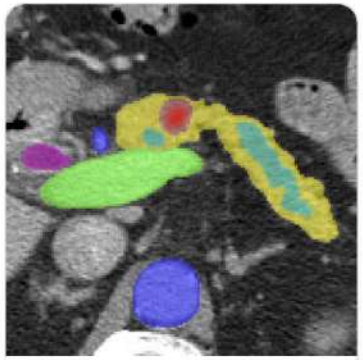
Algorithms

We have made several machine learning algorithms available that you can try out by uploading your own anonymised medical imaging data. Please contact us if you would like to make your own algorithm available here.

+ Add a new algorithm

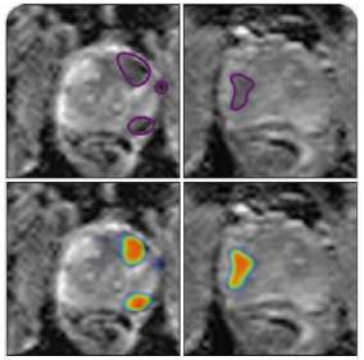
Filter Algorithms

147 algorithms found

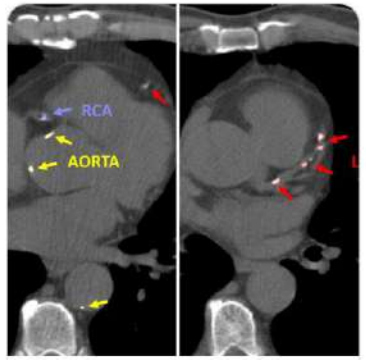


Pancreatic Ductal Adenocarcinoma Detection in CT

Article

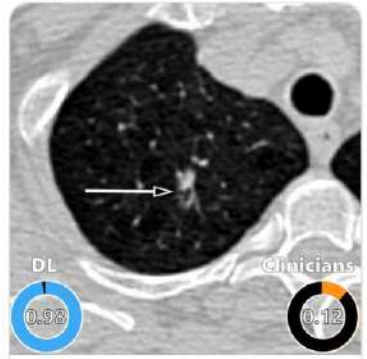


Clinically Significant Prostate Cancer Detection in bpMRI using models trained with Report Guided Annotations



Calcium scoring in CT showing the heart

Article



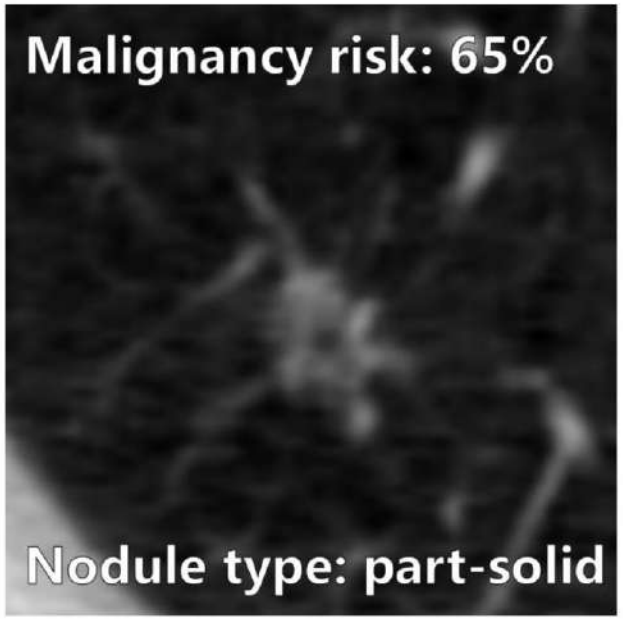
Pulmonary Nodule Malignancy Prediction

Article

Information
Containers
Editors
Users
Requests 2
Try-out Algorithm
Results

LUNA22-ISMI Baseline

Update Settings
Update Description
Publish Algorithm



About

Creators: jacobsc, kiranvaidhya

Contact email: kiranvaidhya.venkadesh@radboudumc.nl

Information
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Container Images

New container images will be automatically built when https://github.com/DIAGNijmegen/bodyct-luna22-ismi-algorithm-baseline is tagged. However, if you wish, you can still upload container images here.

Update Linked Repo | Upload a Container

Container image uploaded by kiranvaidhya 5 months, 2 weeks ago Import Completed Inactive

Build Succeeded Container image from diagnijmegen-bodyct-luna22-ismi-algorithm-baseline:v1-1 Import Completed Inactive

Build Succeeded Container image from diagnijmegen-bodyct-luna22-ismi-algorithm-baseline:v1-1-1 Import Completed Inactive

Build Succeeded Container image from diagnijmegen-bodyct-luna22-ismi-algorithm-baseline:v1-2-1 Import Completed Inactive

Build Succeeded Container image from diagnijmegen-bodyct-luna22-ismi-algorithm-baseline:v1-2-2 Import Completed Active

Grand Challenge

https://luna22-ismi.grand-challenge.org/evaluation/challenge/submissions/create/

Grand Challenge Challenges Algorithms ••• Help

Info Forum Teams Submit Leaderboards Admin Statistics Join

Phase 1 Phase 2 Your Submissions

Phase 1 Submission

Create a new submission

Challenge participants will be allowed to create 10 submissions per 90 days until June 13, 2022, 11:59 p.m. (Europe/Amsterdam) to this phase.

You can change the submission limit and period and the submission start and end dates in Phase Settings.

As an admin for this challenge you can create as many submissions as you like.

Please use this form if you would like to create a submission on the behalf of one of the participants of this challenge.

Supplementary File

--- Browse

Algorithm*

Select one of your algorithms to submit as a solution to this challenge. If you have not created your algorithm yet you can do so on this page.

Save

How do I evaluate the submissions?

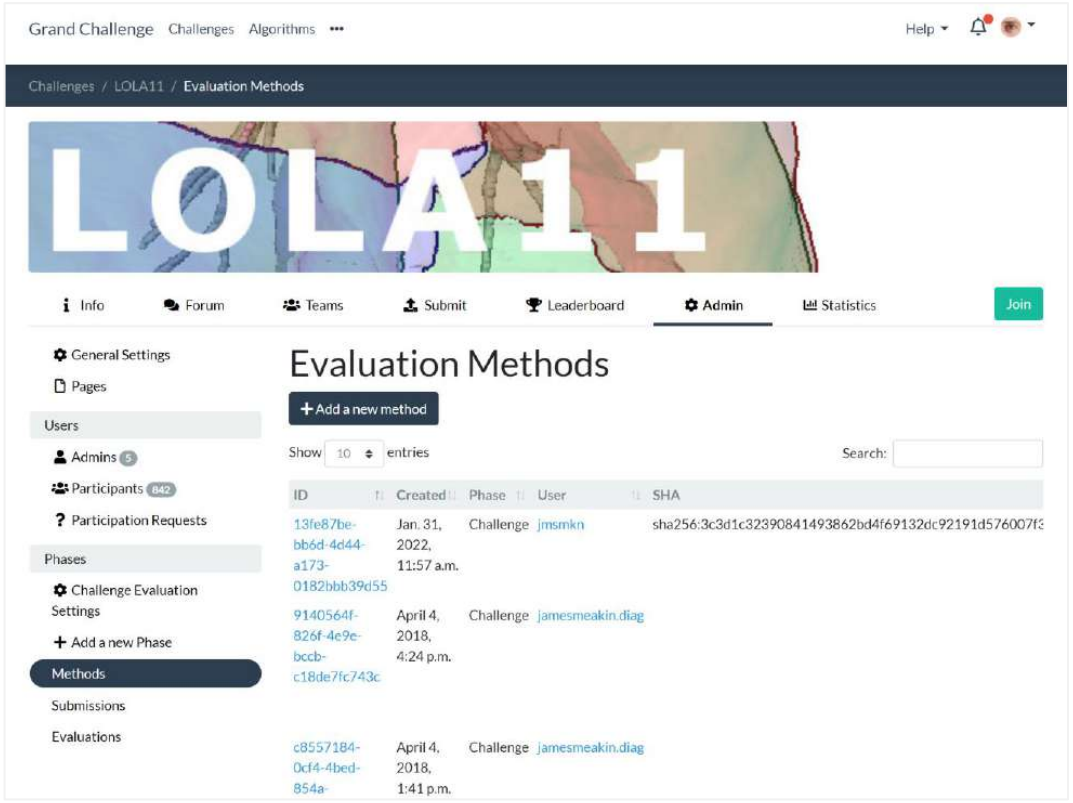
	Wiki – to create a site, add, and edit pages
	User management – registration, teams, forums
	Secure ways to host challenge data, and upload algorithms
	Automated evaluation

Containerize your evaluation scripts – **pip install evalutils**

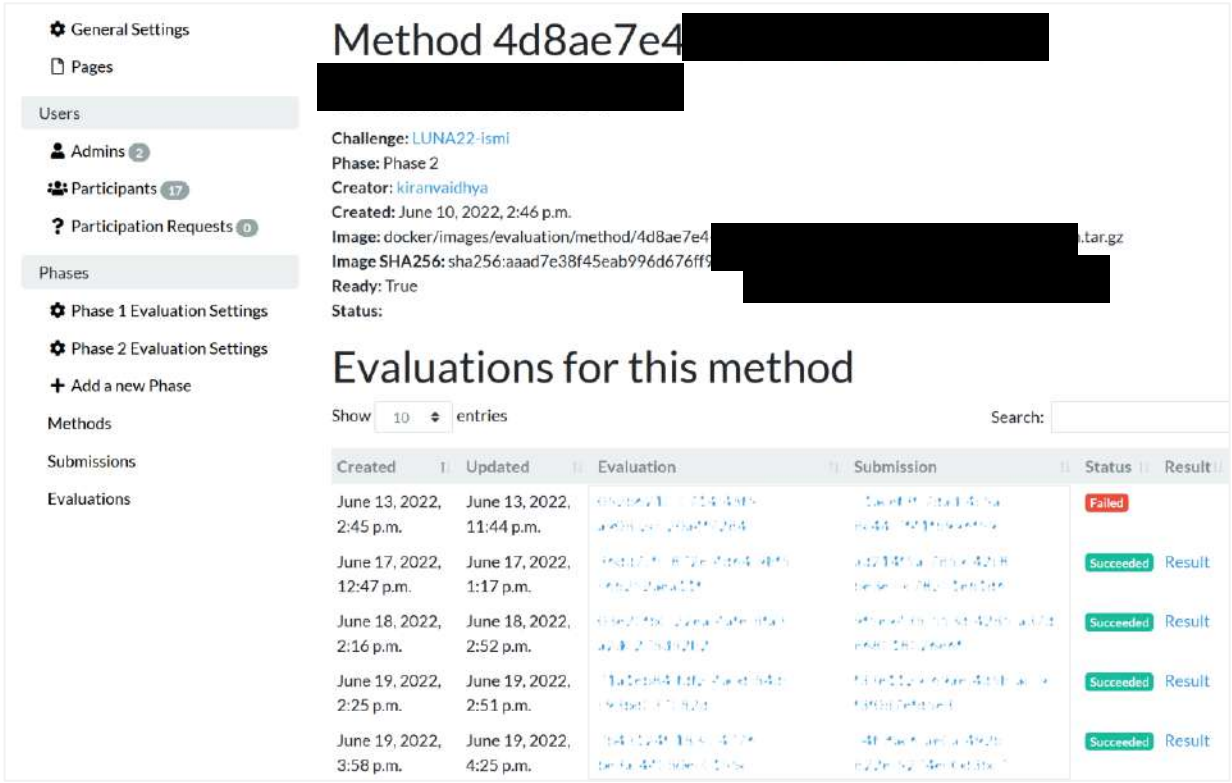
- Package the ground truth in your container
- Read predictions from /input
- Evaluate and write metrics to /output/metrics.json

Upload your evaluation container

Add evaluation method

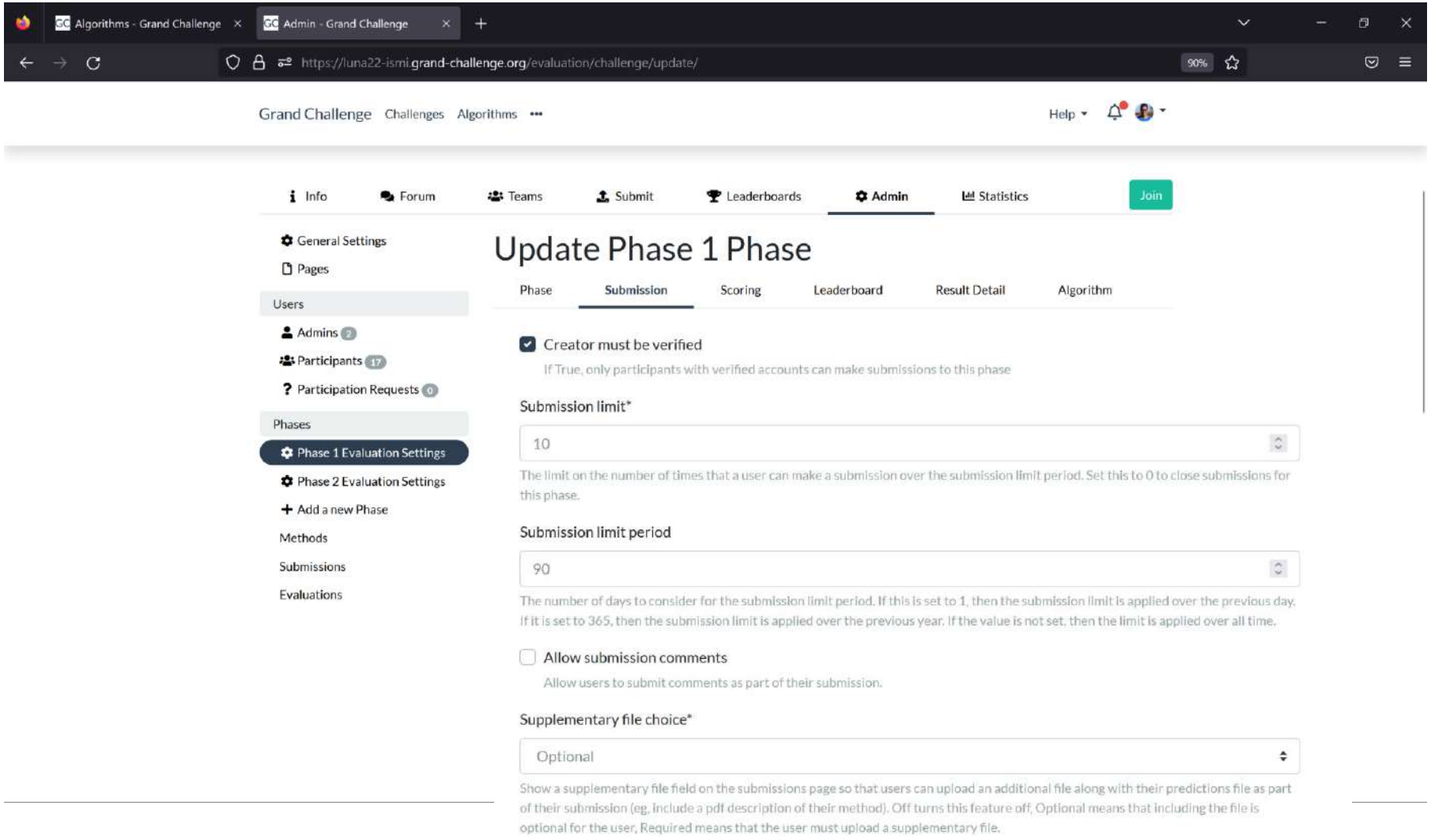


Inspect submissions and evaluations



Very helpful for participants!

Throttle submissions

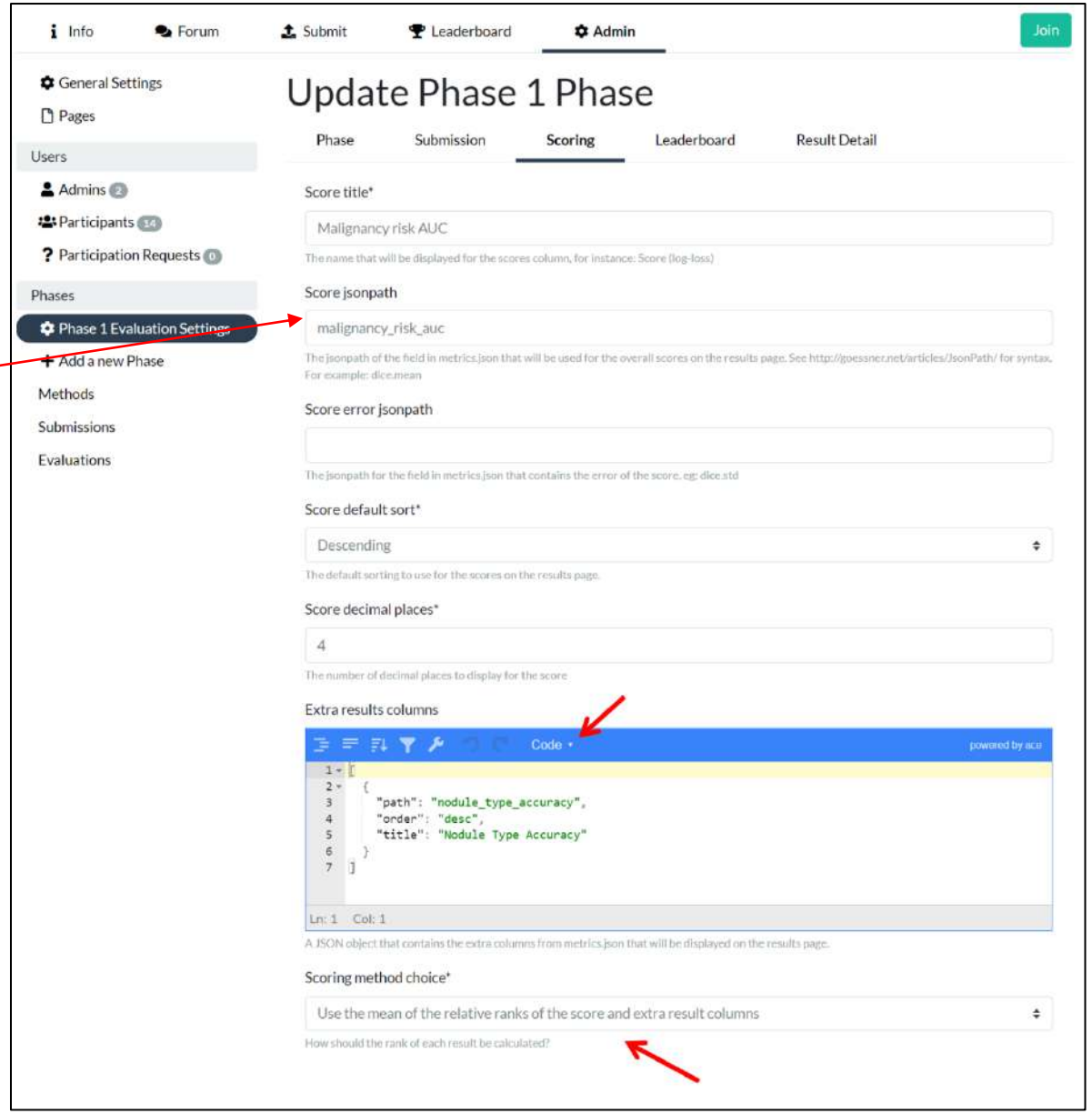


How do I compare submissions?

	Wiki – to create a site, add, and edit pages
	User management – registration, teams, forums
	Secure ways to host challenge data, and upload algorithms
	Automated evaluation
	Automated leaderboard management

Connect evaluation metrics to the leaderboard

```
{
    "malignancy_risk_auc": 0.85,
    "nodule_type_accuracy": 0.75
}
```



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Qualification (last submission) Leaderboard

Search:

Additional metrics Show all metrics

#	User (Team)	Algorithm	Created	AUC Severity
1st	simon.j	Balaitous	9 April 2022	0.8044
2nd	lorenjul (Code 1055)	Chatschapuri-Algorithm	13 April 2022	0.7868
3rd	titericz	Giba-Algorithm	14 April 2022	0.7837
4th	etro	ETRO VUB 3	13 April 2022	0.7752
5th	miriamelia (uaux2)	Stoic2021 - COVID-19 lung ct scans - team Augsburg	12 April 2022	0.7662
6th	mayugmaniparambil (hal9000)	simple-baseline	14 April 2022	0.7656
7th	conga (Flying Bird)	STOIC-2022-0412	13 April 2022	0.7479

We also have an API

	Wiki – to create a site, add, and edit pages
	User management – registration, teams, forums
	Secure ways to host challenge data, and upload algorithms
	Automated evaluation
	Automated leaderboard management
	REST API

Algorithms - Grand Challenge | Balaitous - Grand Challenge

https://grand-challenge.org/algorithms/logistic-regression/

Grand Challenge Challenges Algorithms ••• Help

Information
Try-out Algorithm
Results

Balaitous

```python
import gcapi

client = gcapi.Client(token="your-gcapi-token")

algorithm = client.algorithms.detail(slug="logistic-regression")

job = client.run_external_job(
    algorithm="logistic-regression",
    inputs={"ct-image": ["/path/to/mha/file"]}
)
```

Version:	59a5ba2f-dce4-4117-bad8-e19f6199e964
Last updated:	April 8, 2022, 6:33 p.m.
Inputs:	• CT Image (Any CT image)
Outputs:	• Probability COVID-19 (Probability of a positive RT-PCR result) • Probability Severe COVID-19 (Probability of death or intubation at 1-month follow up)

Results for Balaitous

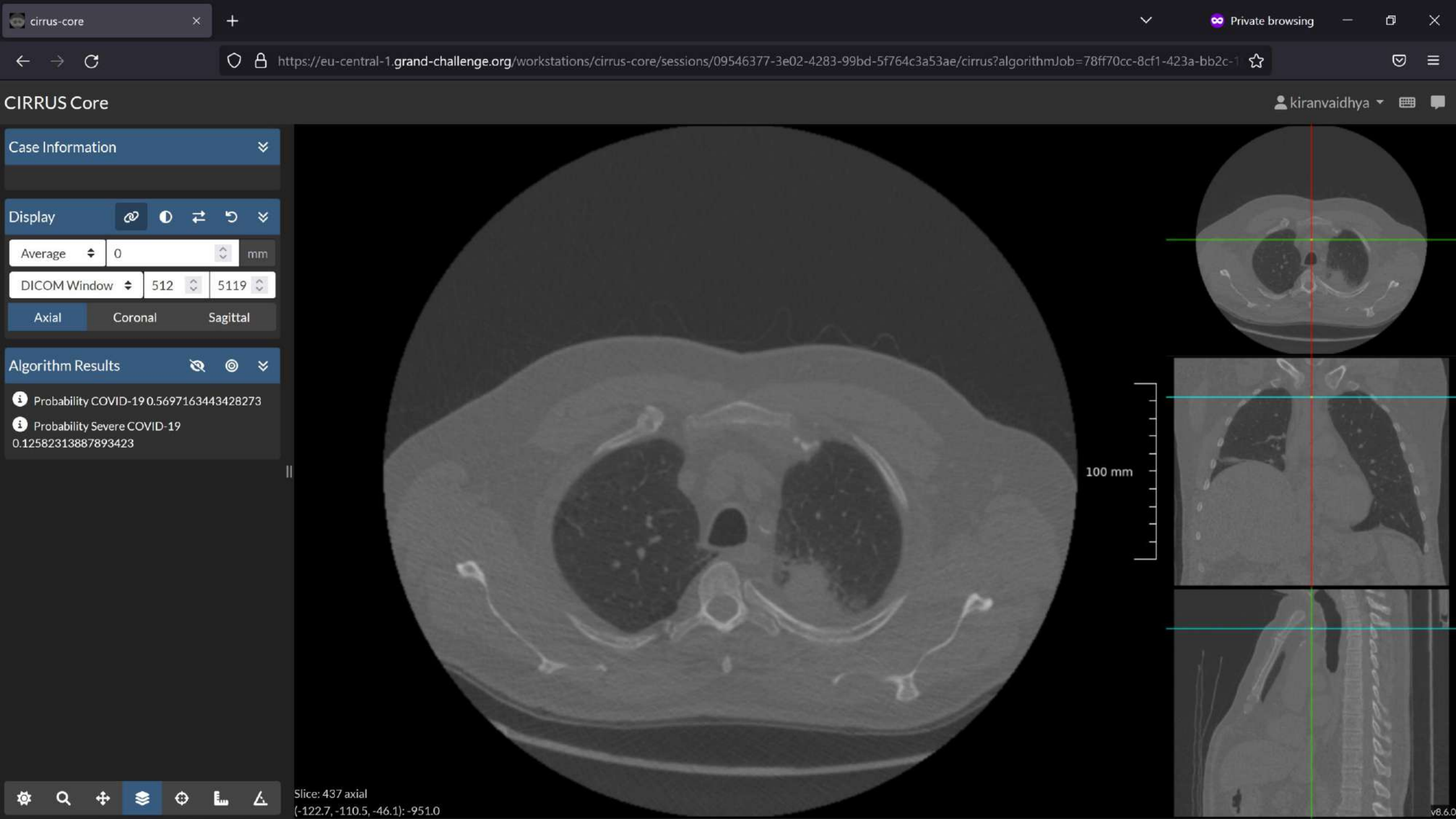
Try-out Algorithm

Search:

Details	Created	Creator	Result	Comment	Visibility	Viewer	Probability COVID-19
	27 minutes ago	kiranvaidhya	FMYUCNKVKE3UG6... (Succeeded, with warnings)			Open Result in Viewer	0.5697163443428273
	3 weeks, 6 days ago	simon.j	study_1067.nii... (Succeeded, with warnings)			Open Result in Viewer	0.6936207362771412

Showing 1 to 2 of 2 entries

Previous 1 Next


cirrus-core
Private browsing
https://eu-central-1.grand-challenge.org/workstations/cirrus-core/sessions/09546377-3e02-4283-99bd-5f764c3a53ae/cirrus?algorithmJob=78ff70cc-8cf1-423a-bb2c-1
CIRRUS Core
kiranvaidhya
Case Information
Display
Average
0
mm
DICOM Window
512
5119
Axial
Coronal
Sagittal
Algorithm Results
Probability COVID-19 0.5697163443428273
Probability Severe COVID-19
0.12582313887893423
100 mm
Slice: 437 axial
(-122.7, -110.5, -46.1): -951.0
v8.6.0

Contact support@grand-challenge.org

grand-challenge.org/documentation

	Wiki – to create a site, add, and edit pages
	User management – registration, teams, forums
	Secure ways to host challenge data, and upload algorithms
	Automated evaluation
	Automated leaderboard management
	REST API

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