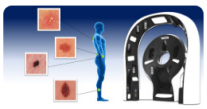
INTERNATIONAL SKIN IMAGING COLLABORATION (ISIC) · RESEARCH CODE COMPETITION · 8 DAYS TO GO

Submit Prediction

ISIC 2024 - Skin Cancer Detection with 3D-TBP

Identify cancers among skin lesions cropped from 3D total body photographs



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Overview

In this competition, you'll develop image-based algorithms to identify histologically confirmed skin cancer cases with single-lesion crops from 3D total body photos (TBP). The image quality resembles close-up smartphone photos, which are regularly submitted for telehealth purposes. Your binary classification algorithm could be used in settings without access to specialized care and improve triage for early skin cancer detection.

Start
2 months ago

Close
8 days to go

Merger & Entry

Competition Host

International Skin Imaging Collaboration (ISIC)

Prizes & Awards

$80,000
Awards Points & Medals

Participation

12,971 Entrants
3,177 Participants
2,574 Teams
65,574 Submissions

Tags

Image | Binary Classification | Cancer | Global | Neural Networks | Custom Metric

Description

Skin cancer can be deadly if not caught early, but many populations lack specialized dermatologic care. Over the past several years, dermoscopy-based AI algorithms have been shown to benefit clinicians in diagnosing melanoma, basal cell, and squamous cell carcinoma. However, determining which individuals should see a clinician in the first place has great potential impact. Triaging applications have a significant potential to benefit underserved populations and improve early skin cancer detection, the key factor in long-term patient outcomes.

Dermatoscope images reveal morphologic features not visible to the naked eye, but these images are typically only captured in dermatology clinics. Algorithms that benefit people in primary care or non-clinical settings must be adept to evaluating lower quality images. This competition leverages 3D TBP to present a novel dataset of every single lesion from thousands of patients across three continents with images resembling cell phone photos.

This competition challenges you to develop AI algorithms that differentiate histologically-confirmed malignant skin lesions from benign lesions on a patient. Your work will help to improve early diagnosis and disease prognosis by extending the benefits of automated skin cancer detection to a broader population and settings.

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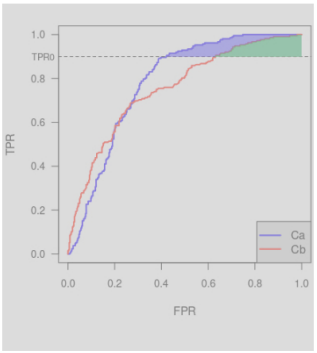
Evaluation

Primary Scoring Metric

Submissions are evaluated on **partial area under the ROC curve (pAUC)** above 80% true positive rate (TPR) for binary classification of malignant examples. (See the implementation in the notebook ISIC pAUC-aboveTPR.)

The receiver operating characteristic (ROC) curve illustrates the diagnostic ability of a given binary classifier system as its discrimination threshold is varied. However, there are regions in the ROC space where the values of TPR are unacceptable in clinical practice. Systems that aid in diagnosing cancers are required to be highly-sensitive, so this metric focuses on the area under the ROC curve AND above 80% TRP. Hence, scores range from [0.0, 0.2].

The shaded regions in the following example represents the pAUC of two arbitrary algorithms (Ca and Cb) at an arbitrary minimum TPR:



(opens in a new tab)">"pAUC defined by constraining TPR" by ProfGigio is licensed under CC-BY-SA-4.0

Submission File

For each image (`isic_id`) in the test set, you must predict the probability (`target`) that the lesion is **malignant**. The file should contain a header and have the following format:

```
isic_id,target
ISIC_0015657,0.7
ISIC_0015729,0.9
ISIC_0015740,0.8
etc.
```

Timeline

- **June 26, 2024** - Start Date.
- **August 30, 2024** - Entry Deadline. You must accept the competition rules before this date in order to compete.
- **August 30, 2024** - Team Merger Deadline. This is the last day participants may join or merge teams.
- **September 6, 2024** - Final Submission Deadline.
- **September 20, 2024** - Deadline for potential prize-winners to publish their solution code and write-ups.

All deadlines are at 11:59 PM UTC on the corresponding day unless otherwise noted. The competition organizers reserve the right to update the contest timeline if they deem it necessary.

Prizes

Leaderboard Prizes

$65,000 will be awarded to the Top 5 teams with the highest scores on the Kaggle Leaderboard at the conclusion of the competition:

- 1st Place - $20,000
- 2nd Place - $15,000
- 3rd Place - $10,000
- 4th Place - $10,000
- 5th Place - $10,000

In addition to the standard Kaggle Winners' Obligations (open-source licensing requirements, solution packaging/delivery), prize winners are required to:

1. post a solution writeup of at least 500 words, and including figures and/or tables, to the competition forum (Example from prior 1st place winner) by September 20th (within 14 days after the competition closes),
2. publish a link to your open sourced code on the competition forum, and
3. [optional] provide a short presentation (video recording is okay) for the ISIC workshop at MICCAI 2024.

All teams, regardless of place, are encouraged to publish a manuscript on arXiv of their solution (and open source their code, if willing). These formal contributions will help advance timely diagnosis and treatment of skin cancer.

Secondary Prizes

$15,000 in additional prizes will be awarded at the conclusion of the competition. All submitted CPU-only solutions are automatically considered.

- **Top-15 Retrieval Sensitivity (winner receives $7,500)**
- **Model Efficiency (winner receives $7,500)**

Code Requirements

This is a Code Competition

Submissions to this competition must be made through Notebooks. In order for the "Submit" button to be active after a commit, the following conditions must be met:

- CPU Notebook <= 12 hours run-time
- GPU Notebook <= 12 hours run-time
- Internet access disabled
- Freely & publicly available external data is allowed, including pre-trained models
- Submission file must be named `submission.csv`

Please see the Code Competition FAQ for more information on how to submit. And review the code debugging doc if you are encountering submission errors.

Secondary Prize Metrics

Top-15 retrieval sensitivity

Consider a dermatologist conducting a full body skin exam for each patient that visits the clinic. Each patient undergoes 3D TBP prior to meeting the dermatologist in the examination room. The dermatologist has just a few minutes to spend with each patient, which is not enough time to view every lesion with their trusted dermatoscope. It would be helpful if, by the time the dermatologist walked into the room, an AI algorithm efficiently recommended an arbitrary number of each patient's most high-risk lesions.

To address this triaging application, one secondary prize will be awarded to the algorithm that is most successful in scoring malignancies within the top-15 highest scored images per patient. In the event of a tie, the algorithm that ranks the detected malignancies highest among those top-15 lesions per patient will win the secondary prize. All primary submissions will be considered for this secondary prize.

The scoring algorithm counts the number of positive samples found among the highest 15 scored images per patient. We adjust the count based on the number of malignancies per patient. For example, if a patient has only one malignancy, and that one is found, that counts as 1. If a patient has 3 malignancies, and 2 are in the top-15 scores, it counts as 0.667. Next, we sum these adjusted values and divide by the number of patients with malignancies. The result is the "average found malignancies, weighted by patient-malignancies" to determine the winner. The code for computing this metric across a set of submissions can be found at the following repository: https://github.com/ISIC-Research/Challenge-2024-Metrics/tree/main

Model efficiency

For the efficiency prize, we will evaluate submissions on both runtime and diagnostic accuracy.

To be eligible for the Efficiency Prize, a submission

- Must be among the submissions selected by a team for the Leaderboard Prize
- Must be ranked on the Private Leaderboard higher than the `BENCHMARK.csv` benchmark

All submissions meeting these conditions will be considered for the Efficiency Prize. A submission may be eligible for both the Leaderboard Prize and the Efficiency Prize.

The Efficiency Prize will be awarded to one eligible submission that scores the best according to the following evaluation metric on the private test data. More details may be posted via discussion forum updates.

We compute a submission's **efficiency** score by:

$$\text{Efficiency} = \frac{\text{pAUC}}{\text{BENCHMARK} - \max \text{pAUC}} + \frac{\text{RuntimeSeconds}}{43200}$$

where `pAUC` is the submission's score on the leaderboard, `BENCHMARK`, is the score of the `benchmark.csv` leaderboard, $\max \text{pAUC}$ is the highest score on the leaderboard, and `RuntimeSeconds` is the number of seconds it takes for the submission to be evaluated. The objective is to minimize the efficiency score.

During the training period of the competition, a leaderboard for the public test data may be updated periodically and posted in a notebook that will be updated daily: **Efficiency Leaderboard**. After the competition ends, we will update the efficiency leaderboard with scores on the *private* test set.

Conference

Since 2016, ISIC has hosted skin image analysis workshops at premier conferences such as MICCAI, CVPR, ECCV, C-MIMI, and ISBI. During the years in which prior ISIC Challenges were held, the prize-winning teams were invited as speakers to present their solutions (ISBI 2016-17, MICCAI 2018-19, & C-MIMI 2020).

ISIC will have a workshop at MICCAI 2024 in Marrakesh (October 6-10) that will include a recap of this competition. We will update this page when we have more information to share.

Background Information

Importance

The three major types of skin cancer are Basal Cell Carcinoma (BCC), Squamous Cell Carcinoma (SCC), and Melanoma. BCC and SCC are very common, with over 5 million estimated cases in the US each year, but relatively unlikely to be lethal. The Skin Cancer Foundation estimates that melanoma, the deadliest form of skin cancer, will be diagnosed over 200,000 times in the US in 2024 and that almost 9,000 people will die from the disease. As with other cancers, early and accurate detection—potentially aided by data science—can make treatment more effective.

Advanced skin cancer is a disfiguring and potentially deadly disease, but if caught early, most can be cured with minor surgery. Automated image analysis tools that allow individuals to assess their own skin lesions may expedite clinical presentation and diagnosis. Better detection of skin cancer presents the opportunity to positively impact hundreds of thousands of people every year.

Clinical Context

Ugly Duckling Sign for Melanoma Diagnosis

Benign moles on an individual tend to resemble each other in terms of color, shape, size, and pattern. Outlier lesions are more likely to be melanoma, an observation known as the "ugly duckling sign". However, most skin lesion classification algorithms are trained for independent analysis of individual skin lesions. The dataset presented here is novel because it represents each person's lesion phenotype more completely. Algorithms may be able to enhance their diagnostic accuracy when taking into account "context" within the same patient to determine which images represent a cancerous outlier.

Representation of common lesions

Dermatologists normally use digital dermoscopy to document the more atypical lesions such as those that undergo biopsy or short-term monitoring. Utilizing this dataset, which includes every lesion from thousands of patients across six continents, helps circumvent the lesion-selection bias inherent to large routinely collected dermoscopy image datasets, where the ordinary benign examples tend to be underrepresented, leading to a theoretical risk of low algorithm specificity when used in non-specialized settings.

Telemedicine

Since the start of COVID-19, telemedicine has become very common. Telemedicine patients are often asked by their providers to submit cellphone photos of their skin conditions. These photos are typically captured by the patient or a family member and the quality of the photos tend to be worse than photos taken in a clinic. AI algorithms that are robust to varying degrees of photo quality could improve quality of care in these situations.

International Skin Imaging Collaboration

The International Skin Imaging Collaboration (ISIC) is an international academia and industry partnership designed to reduce skin cancer morbidity and mortality through the development and use of digital skin imaging applications.

ISIC Grand Challenges

Beginning in 2016, ISIC has sponsored Grand Challenges for the computer science community in association with leading computer vision conferences. Over the years, these challenges have grown in scale, complexity, and participation.

- 2016 ISIC Challenge
- 2017 ISIC Challenge
- 2018 ISIC Challenge
- 2019 ISIC Challenge
- 2020 ISIC Challenge

ISIC Archive

The ISIC Archive is the largest publicly available collection of quality-controlled dermatology skin images. The images are associated with ground-truth diagnoses and other clinical metadata that can be queried using faceted search and downloaded individually or in batches. The initial focus of the Archive has been on dermoscopic images of individual skin lesions, as these images are inherently standardized by the use of a specialized acquisition devices and devoid of many of the privacy challenges associated with clinical images. To date, the images have been provided by specialized melanoma centers from around the world.

Image Modality

3D Whole Body Photography

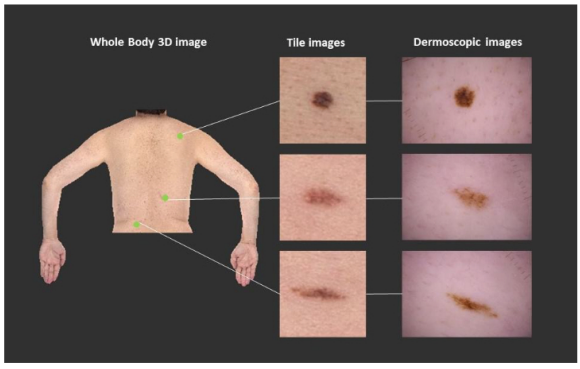
Designed specifically for dermatology, the VECTRA WB360 whole body 3D imaging system captures the entire skin surface in macro quality resolution with a single capture by processing 92 camera images (46 bi-camera positions).

Tiles

The location of each lesion on the patient is detected automatically and exported as individual 15×15 mm field-of-view cropped images. **The test set and training sets are comprised of tiles.** Teams are permitted to use other public datasets for developing algorithms.

Dermoscopy

Dermoscopy refers to the examination of the skin using skin surface microscopy. Dermoscopy requires a high quality magnifying lens and a powerful lighting system (a dermatoscope), which illuminate morphologic features not otherwise visible to the naked eye. Large dermoscopy datasets are available on ISIC.



Acknowledgments

Canfield Scientific

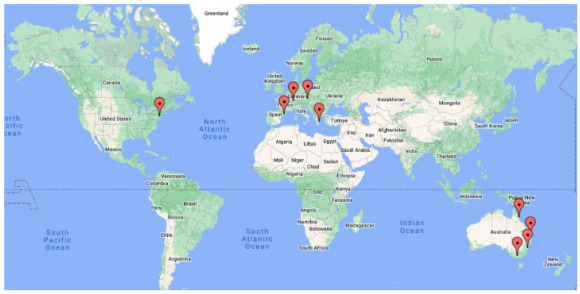
Canfield Scientific manufacturers the Vectra WB360 device and specifically developed the software for extracting images from 3D TBP for use in this competition. We also thank Canfield for supporting the competition prizes.

The Shore Family Foundation

The competition hosts thank the Shore Family Foundation for their support of the ISIC Archive.

The following institutions contributed data for this competition

- Memorial Sloan Kettering Cancer Center, New York, USA
- Dermatology Service, Melanoma Unit, Hospital Clínic de Barcelona, IDIBAPS, Universitat de Barcelona, Barcelona, Spain, ITOBOS
- The University of Queensland, Brisbane, Australia
- FNQH Cairns, Westcourt, Australia
- Melanoma Institute Australia, Sydney, Australia
- Department of Dermatology at the University Hospital of Basel, Basel, Switzerland
- Department of Dermatology, Medical University of Vienna, Vienna, Austria
- Department of Dermatology, University of Athens Medical School, Athens, Greece
- Monash University at the Alfred Hospital, Melbourne, Australia



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1. VECTRA WB360 Half System-Perspective (URL)
2. Photo of Human:
   Credit: angelhell
   Creative #: 183249954
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   Collection: E+
   Max. file size: 6200 × 3345 px (52.49 × 28.32 cm) - 300 dpi - 2 MB
   Uploaded on: October 24, 2010
   Release information: No releases required

- Department of Dermatology, Medical University of Vienna, Vienna, Austria
- Department of Dermatology, University of Athens Medical School, Athens, Greece
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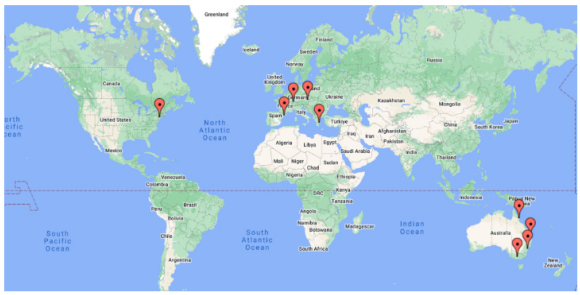

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