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SexEst: An open access web application for metric skeletal sex estimation

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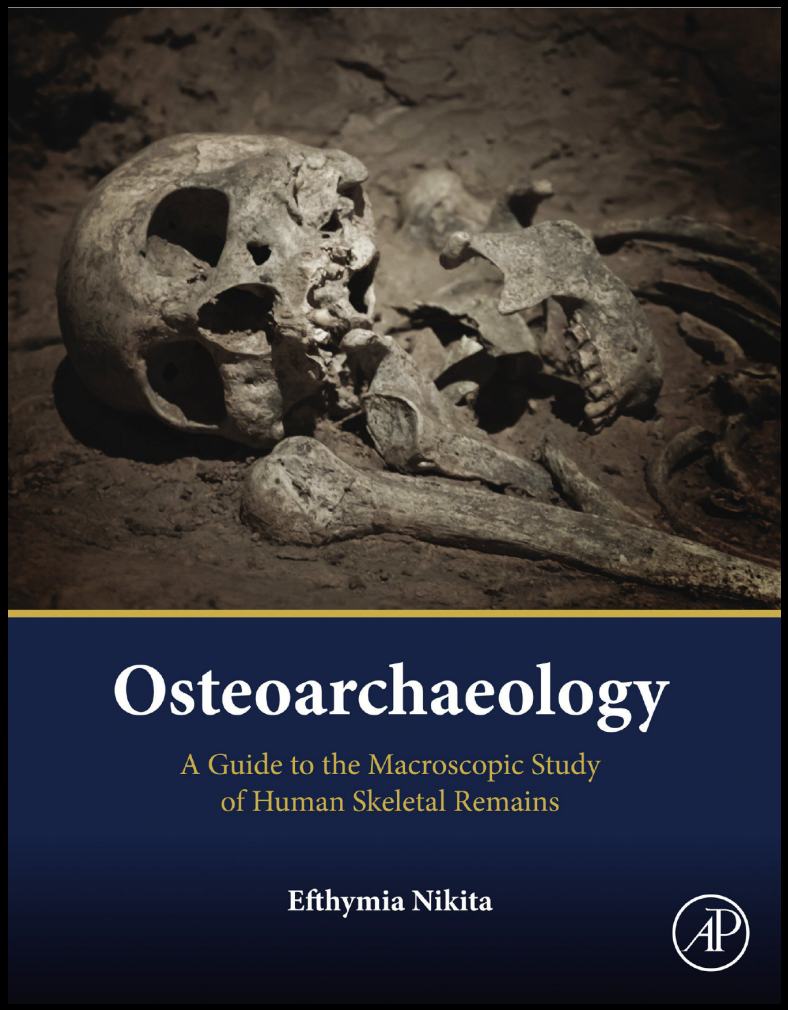
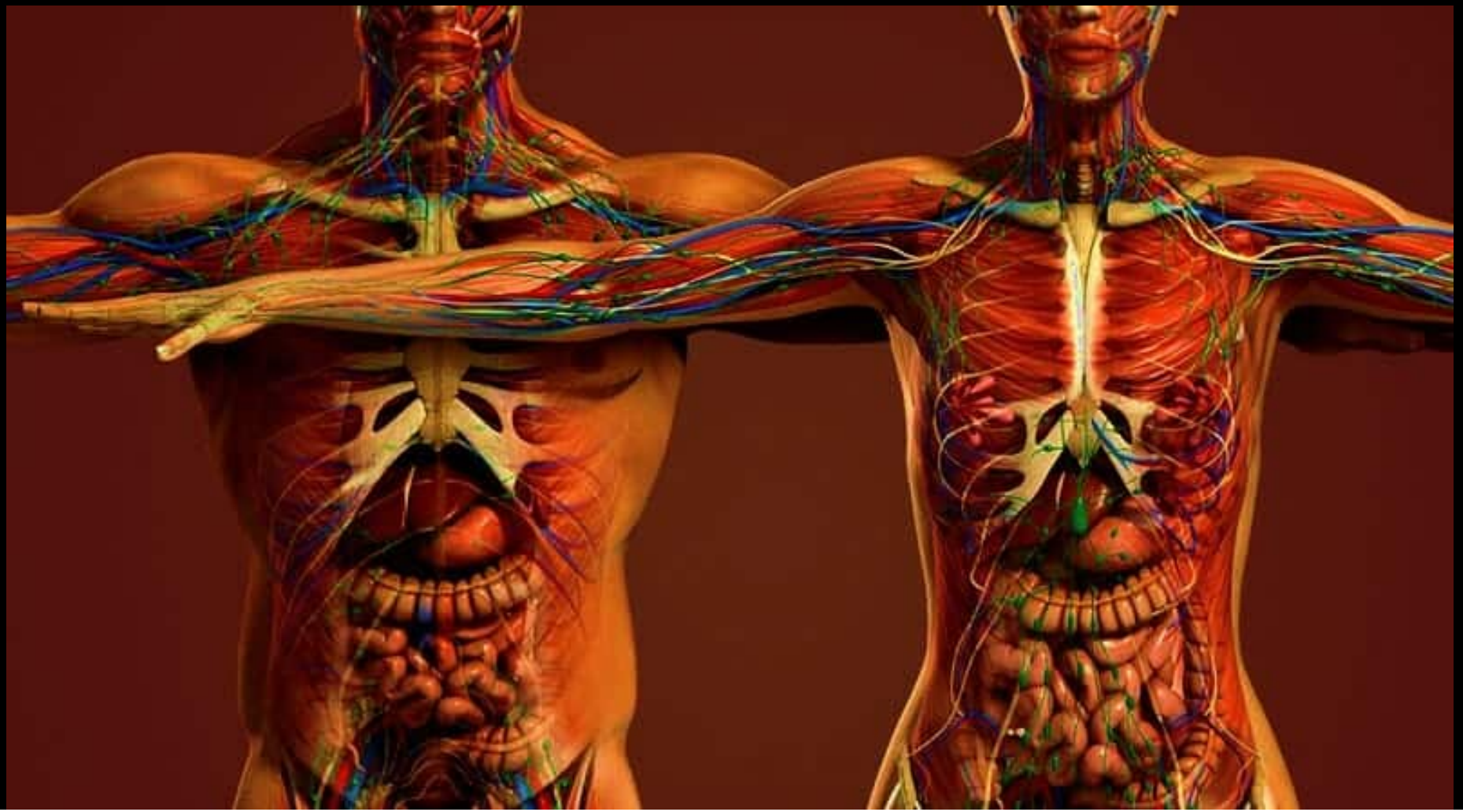
What is osteoarchaeology?

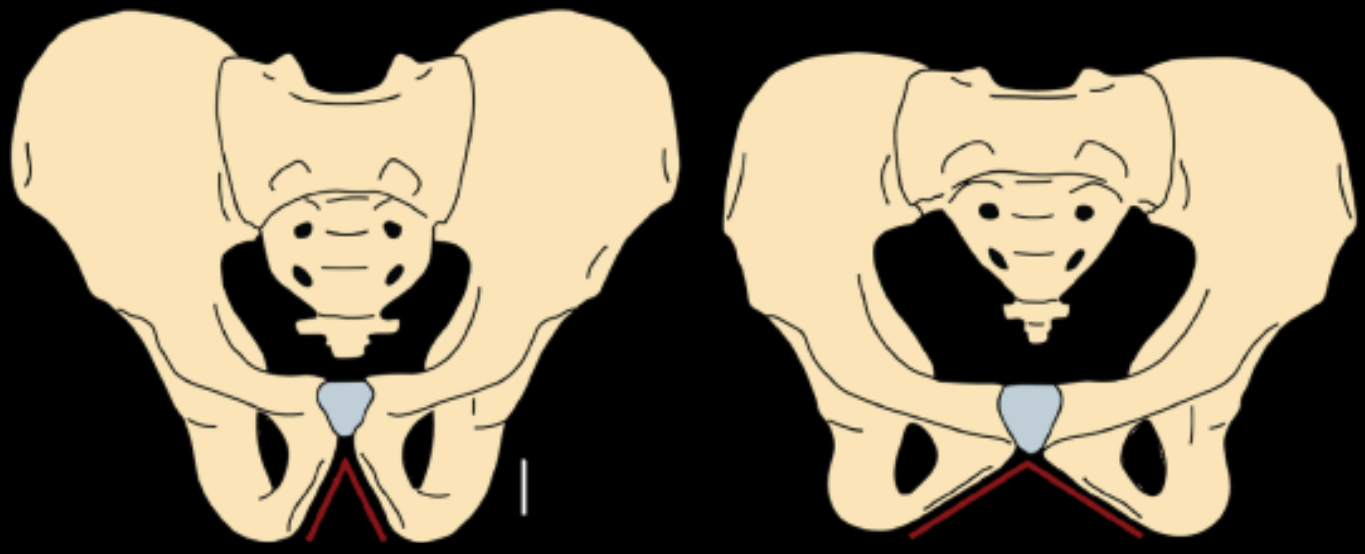


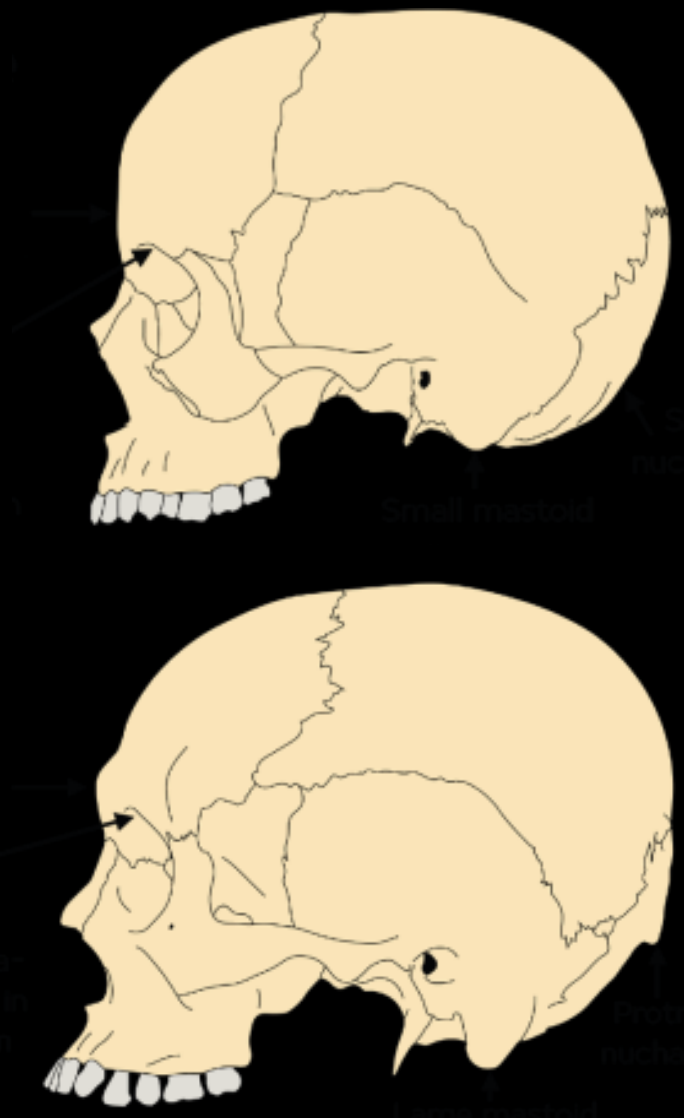
Study of human skeletal remains from archaeological contexts

Sex...even more important than you think!

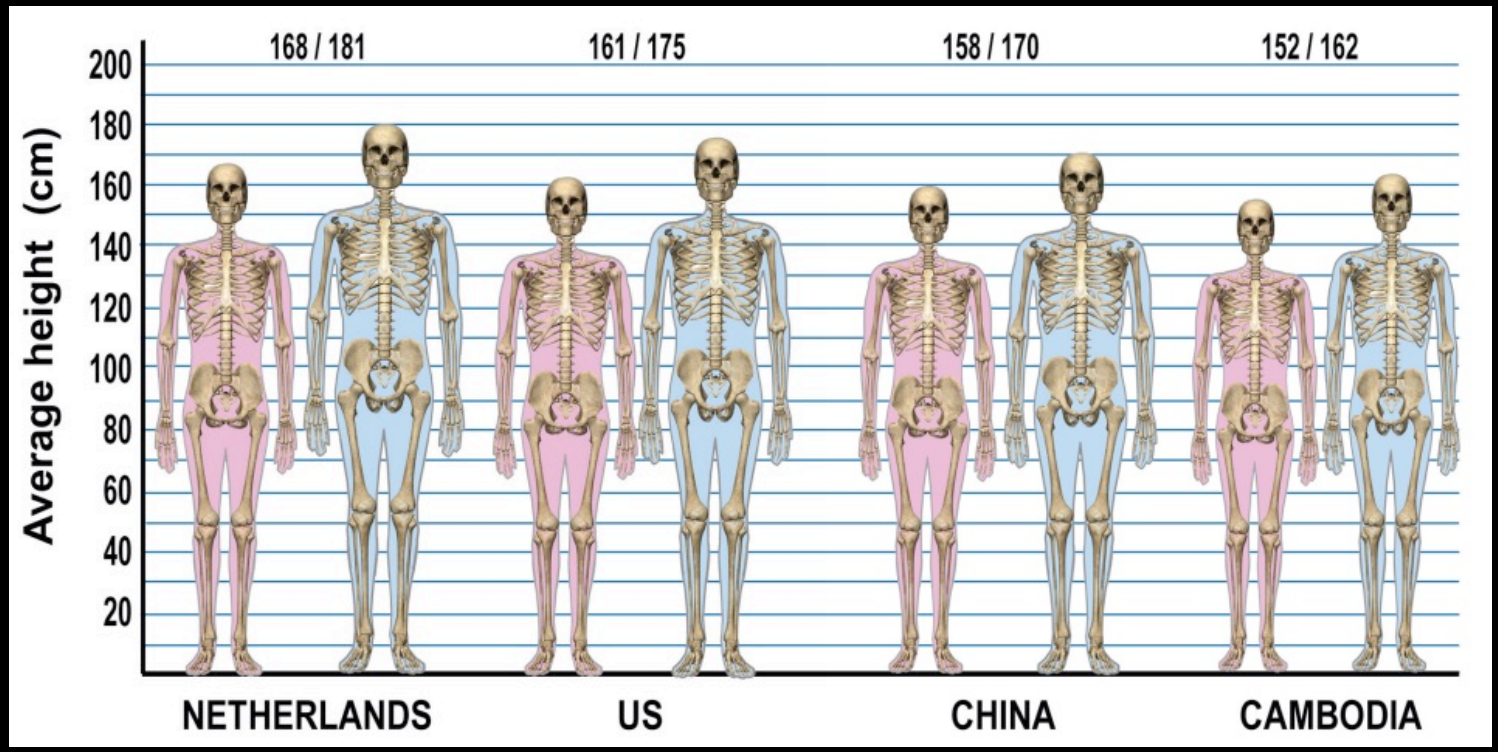


Morphological sex estimation





Metric sex estimation



Making life easier…

osteomics

https://osteomics.com/

Sex diagnosis

CalcTalus - Publication available

CADOES - Publication available

Ammer-Coelho - Publication available

SeuPF - Publication available

DSP (Depcreated, there is now a DSP2 by the official team)

Limitations of current models

- Based on modern assemblages (secular trends?)
- Population-specific methods

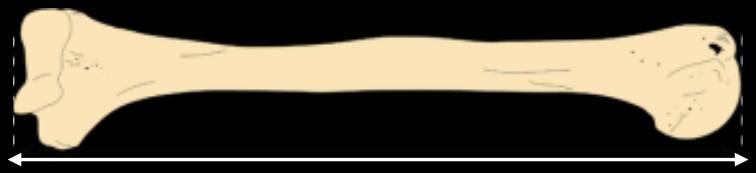
Aim

- Develop an open access and open source web application for multiregional sex prediction

Materials

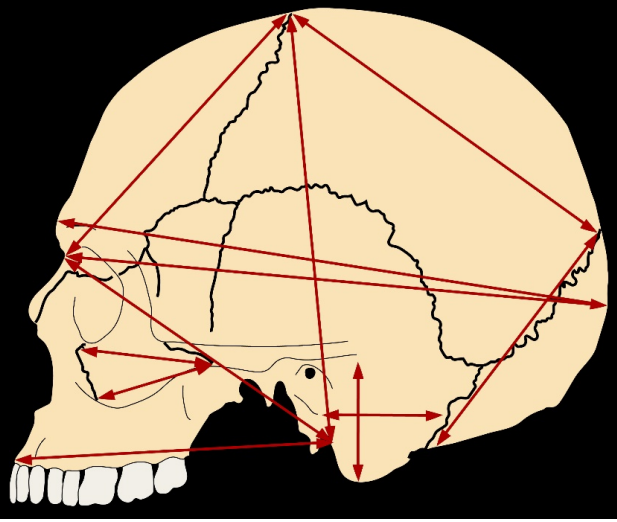
Goldman Dataset

- postcranial measurements
- 1538 skeletons
- from various geographic locations
- data collected by Dr. Benjamin Auerbach



William W. Howells Dataset

- cranial measurements
- 2524 skeletons
- from various geographic locations
- data collected by Dr. William W. Howells



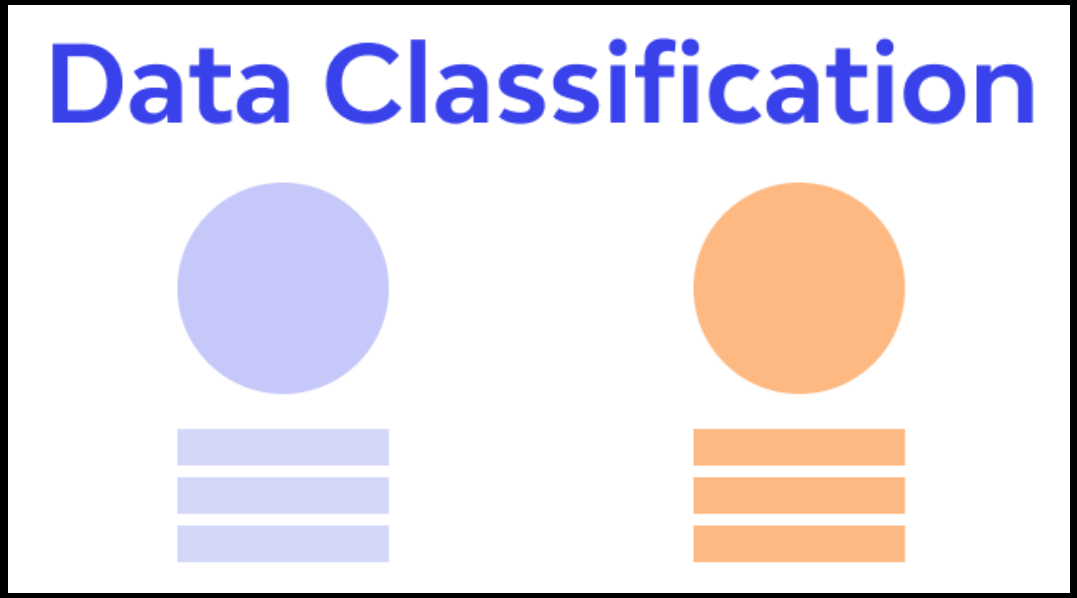
Different machine learning classifiers:

- Logistic Regression
- Decision Trees
- Support Vector Machine
- Gaussian Process
- Gradient Boosting
- Random Forest
- Ada Boosting
- Extra Trees
- Gaussian Naive Bayes
- k-Nearest Neighbors
- Linear Discriminant Analysis
- Quadratic Discriminant Analysis
- Extreme Gradient Boosting
- Light Gradient Boosting

Methods

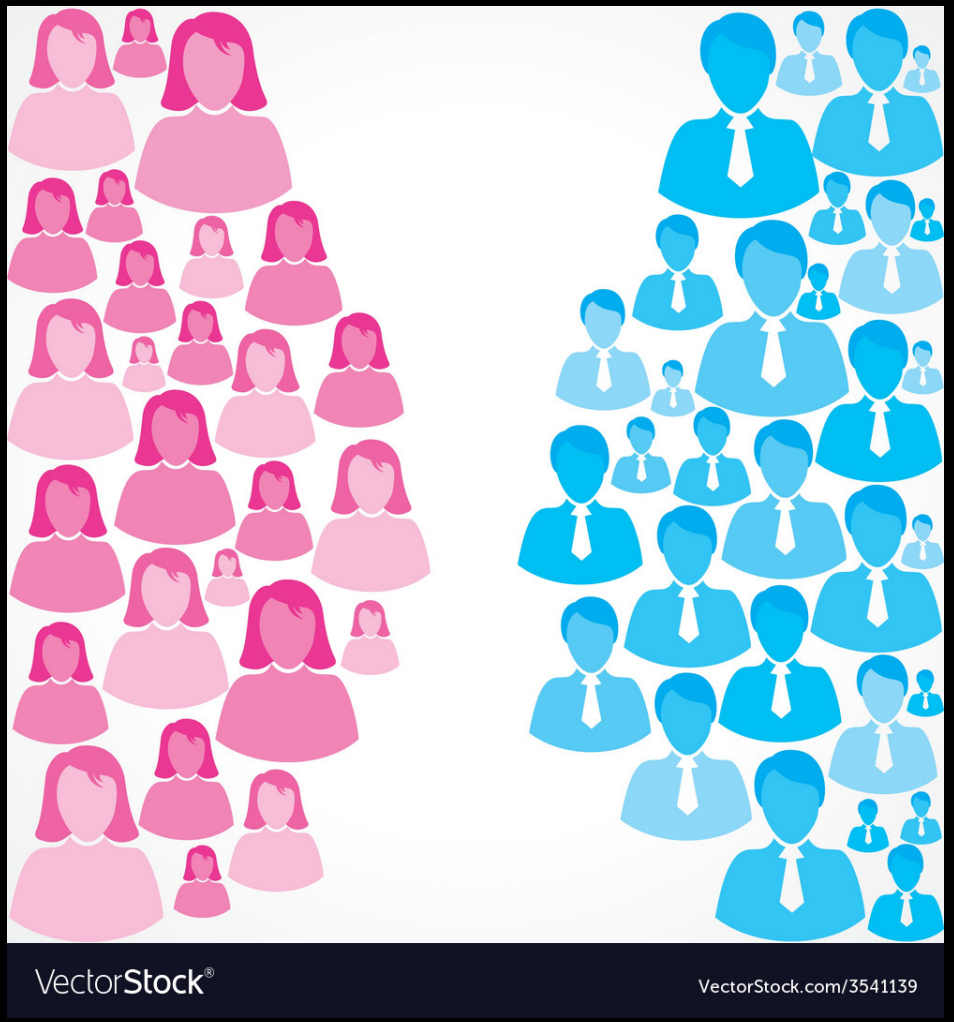
- Different combinations of variables
- Full datasets and missing values

- Python programming language



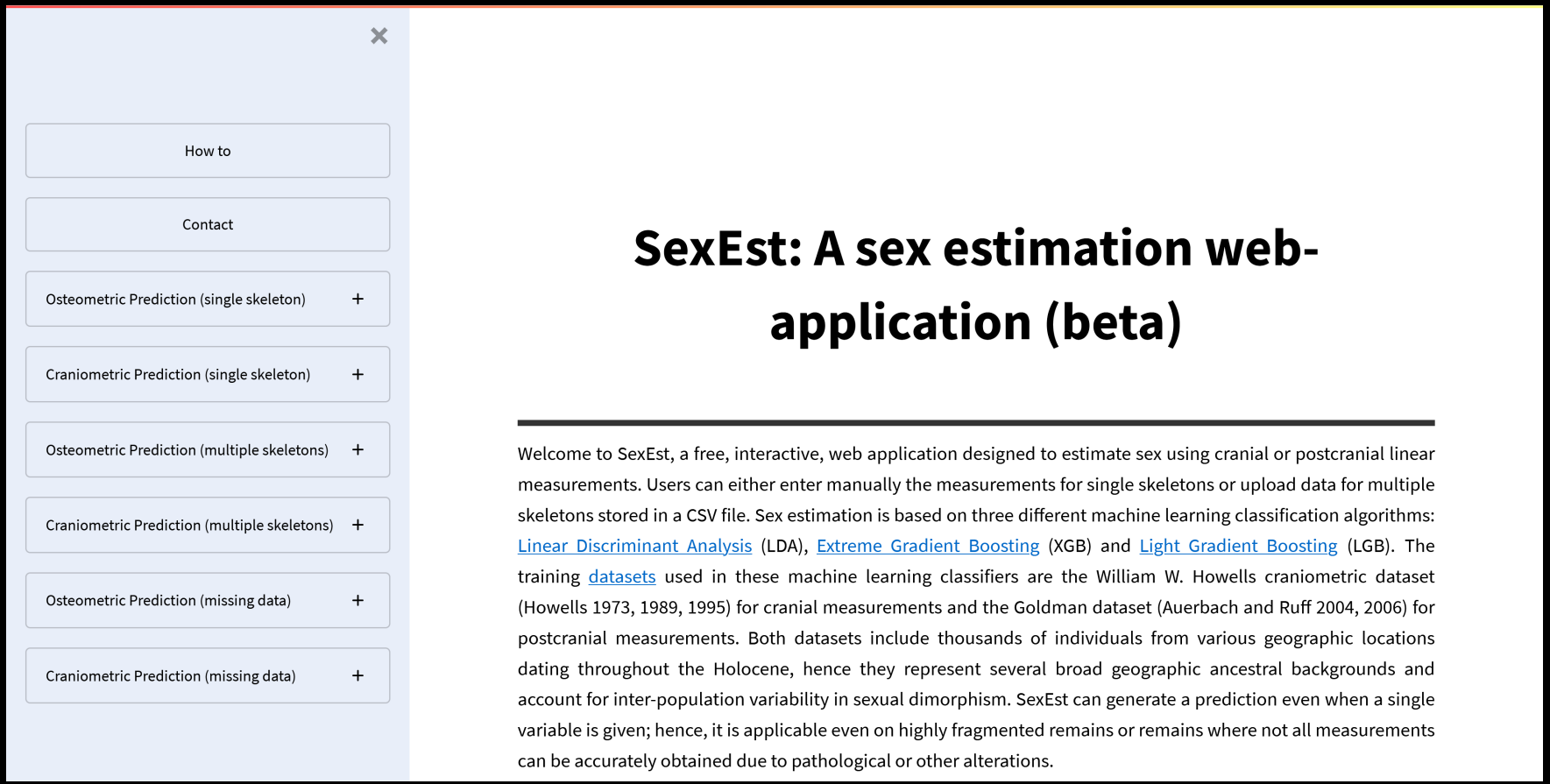
Results

- Highest accuracies
  - Extreme Gradient Boosting
  - Light Gradient Boosting
  - Linear Discriminant Analysis
  - no particular bias in classification
- Cranial measurements (>85%)
- Postcranial measurements (> 87%)



SexEst web application

http://sexest.cyi.ac.cy/



Osteometric prediction – single skeleton

SexEst: A sex estimation web-application (beta)

	BIB	HML	HHD	RML	FML	FBL	FHD	TML	FEB	TPB	HEB
0	266.0	299.0	42.0	255.0	423.0	413.0	46.8	341.0	75.0	69.0	61.2

The probability of the individual being male is 78.98% and the probability of being female is 21.02%

The model was trained using 1528 cases. The dataset was split into a training set and a test set with proportions 70% and 30%, respectively. The model was then trained using the training set and GridSearchCV, which optimized the model's hyperparameters and cross-validated it. The trained model was then tested using the test set, achieving an accuracy of 90.41%.

Osteometric prediction – multiple skeletons

Calculate

Craniometric Prediction (single skeleton) +

Osteometric Prediction (multiple skeletons) −

Choose a CSV file

Drag and drop file here

Limit 200MB per file • CSV

Browse files

sample_dataset_oste… ×

367.0B

Select a model

XGB

Calculate

Craniometric Prediction (multiple skeletons) +

	BIB	HML	HHD	RML	FML	FBL	FHD	TML	FEB	TPB	HEB
0	268.0	352.5	47.07	264.0	463.5	460.5	45.47	387.0	78.0	73.0	60.25
1	257.0	286.5	45.37	236.0	404.0	401.5	42.94	355.0	77.25	66.5	58.5
2	256.0	313.25	52.16	237.5	441.25	436.0	48.41	337.5	79.75	74.0	63.5
3	254.0	292.5	44.36	233.0	417.5	413.5	45.95	346.0	74.5	67.0	59.5
4	256.0	299.5	43.02	240.0	411.75	408.0	43.91	359.25	79.75	68.0	65.5

	Male	Female
0	99.77	0.23
1	98.2	1.8
2	99.68	0.32
3	98.07	1.93
4	99.92	0.08

Please note that any rows containing missing data will be dropped as these models have been optimized to work with all 11 variables submitted. You can try the **Osteometric Prediction (missing data)** mode for any cases/rows containing missing data.

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Osteometric prediction – missing values

Next steps

Wiley Online Library

Search

International Journal of Osteoarchaeology

RESEARCH ARTICLE

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- Expansion of post-cranial variables
- Validation in different assemblages worldwide

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