What does your skin tell about you?

Extracting ageing, mortality and disease features from skin biopsies using contrastive learning

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Introduction

Abstract

We use a self-supervised contrastive deep learning model to extract ageing-related features from digitised skin biopsies of healthy patients to predict three critical aspects of that individual- the age of the individual, the risk of some diseases at the time of biopsy, and the risk of mortality in the next twenty years after the biopsy

Digitised Skin Biopsy Sample
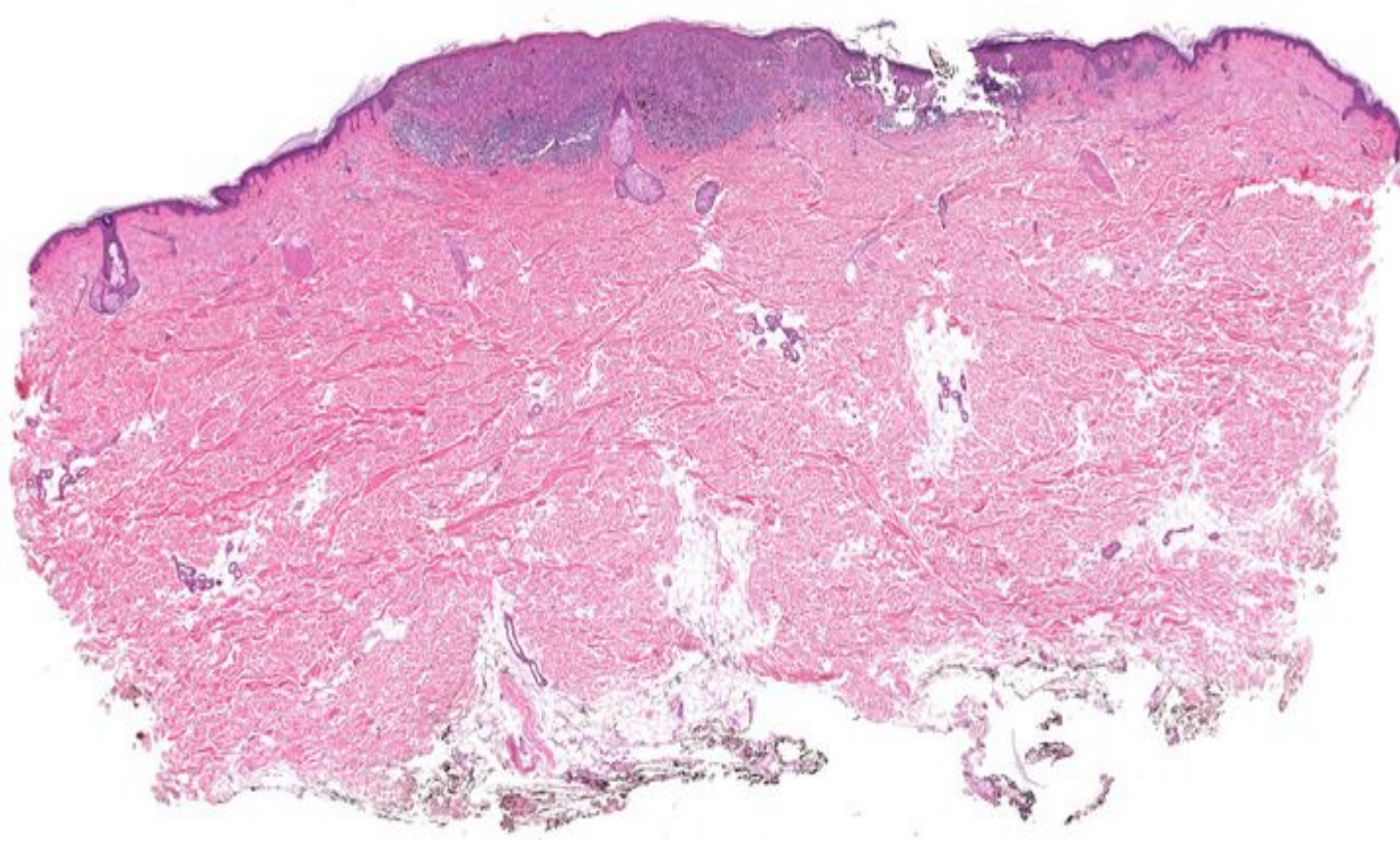
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Research

Data

1787 megapixel digitised skin biopsies from healthy participants from the Danish National Registry of Pathology (DNRP)
868 females - 919 males of ages 5-101

Processing biopsies

Generate overlapping patches from supersized biopsies
Create contrastive augmentations for each patch
Cluster similarly trained patches together

Models Used

- Contrastive Learning Model (CDL) to extract age-related features from digitised skin biopsies
- xGBoost Models to predict age from CDL features
- xGBoost Models to predict common diseases using predicted age
- Cox Regression Model to predict 20 year mortality

Figure ↓: System setup and models used
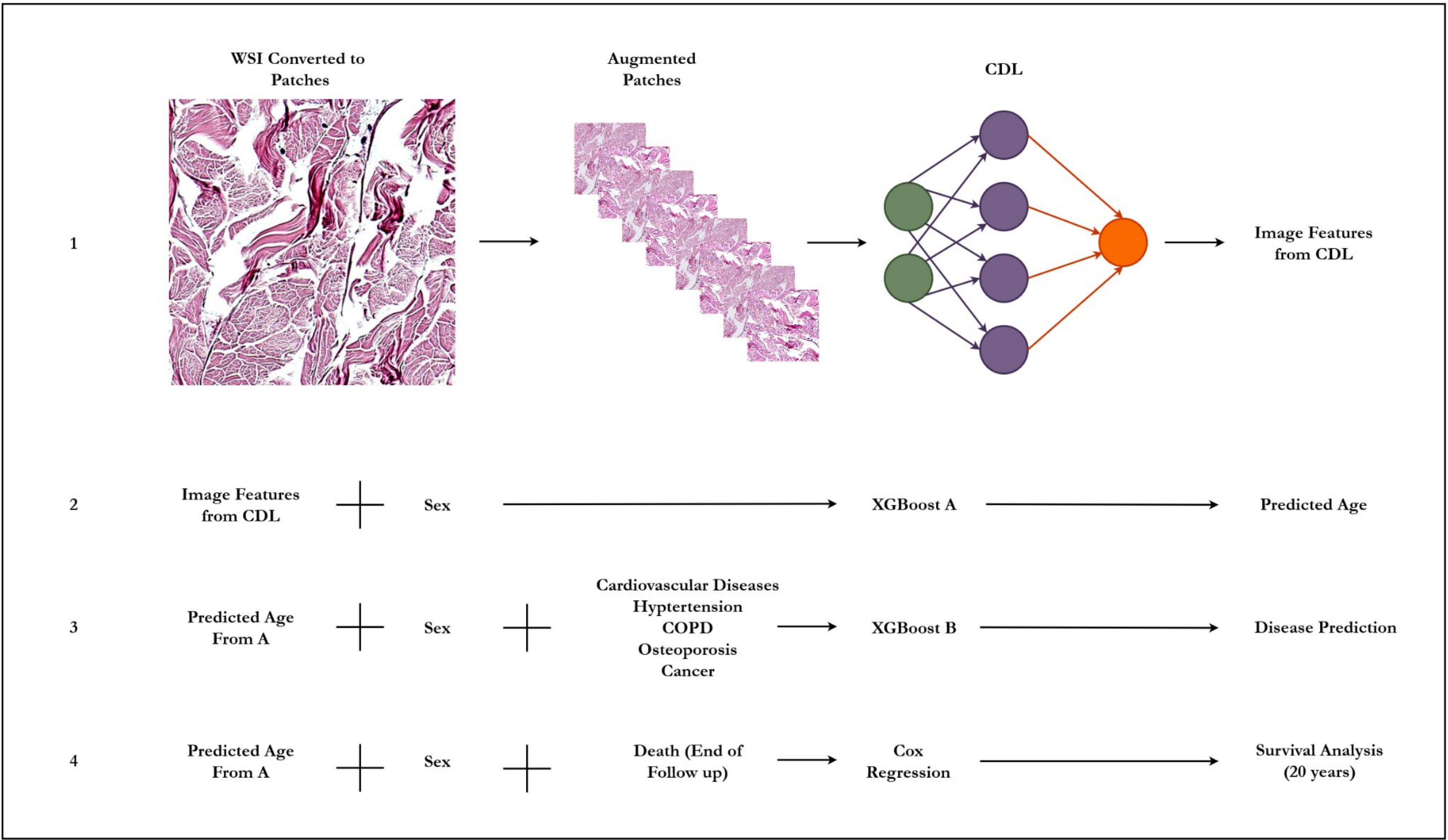
Results

Age Prediction

Sex	MAE
Females	4.17 (2.45 - 5.82)
Males	3.27 (2.12 - 4.31)

Disease Prediction

Disease	Observed Age Accuracy	Predicted Age Accuracy
CVD	0.952	0.967
COPD	0.978	0.988
Osteoporosis	0.977	0.980
Hypertension	0.891	0.888
Cancer	0.748	0.752

Survival Analysis