MONASH University

MSHC
MELBOURNE SEXUAL HEALTH CENTRE

Generalizable Segment Anything Model via Selection Strategy for Skin Lesion Segmentation

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Disclosure of interest

- My PhD research is funded by Melbourne Sexual Health Centre (MSHC) and Monash University international student scholarships.
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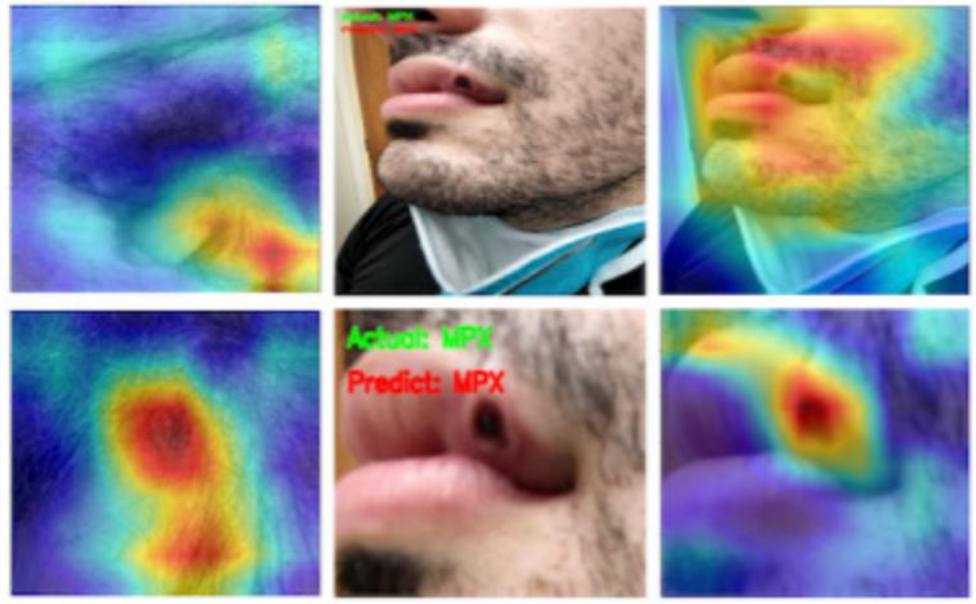
- Research was conducted independently of Helfie.
- No other conflicts of interest to declare.

The Mpox Challenge

The 2022 outbreak required rapid diagnosis

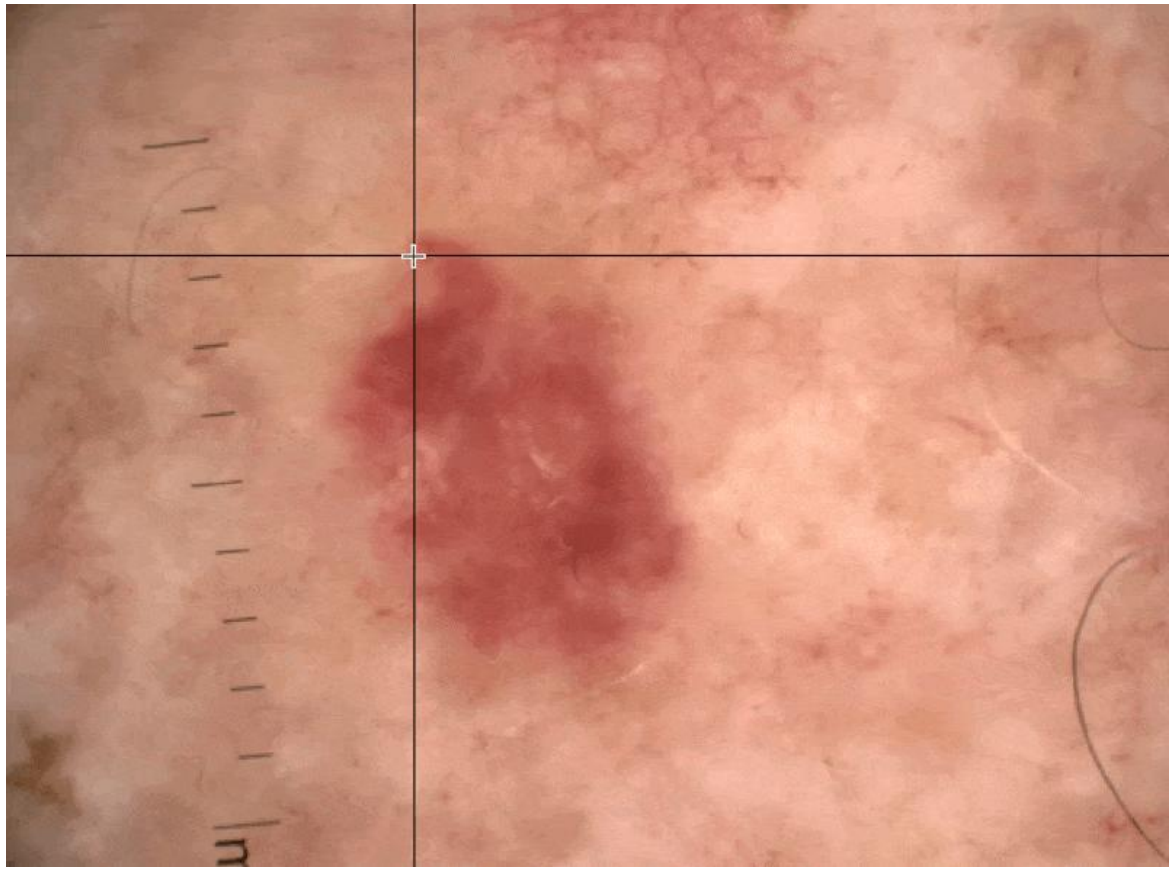
Basic AI model: **85% accuracy**

Black box models lack clinical trust



[1] Sun J, Yu Z, Li Y, et al. Radiomics analysis for the early diagnosis of common sexually transmitted infections and skin lesions[J]. PLOS Digital Health, 2025, 4(7): e0000926.
[2] Sun J, Li Y, Yu Z, et al. Exploring artificial intelligence for differentiating early syphilis from other skin lesions: a pilot study[J]. BMC Infectious Diseases, 2025, 25(1): 40.
[3] Soe NN, Yu Z, Latt PM, Lee D, Samra RS, Ge Z, Rahman R, Sun J, Ong JJ, Fairley CK, Zhang L. Using AI to Differentiate Mpox From Common Skin Lesions in a Sexual Health Clinic: Algorithm Development and Validation Study. J Med Internet Res. 2024 Sep 13;26:e52490. doi: 10.2196/52490. PMID: 39269753; PMCID: PMC11437223.

The Segmentation Challenge



1. **Manual Boundary Labelling**
   Precise lesion borders needed
2. **Time-Intensive Process**
   1,000 images over several months
3. **Accuracy vs Efficiency**
   Clinician burnout risk

Generalizable Segment Anything Model via Selection Strategy for Skin Lesion Segmentation

🎯 Smart Point Selection Strategy

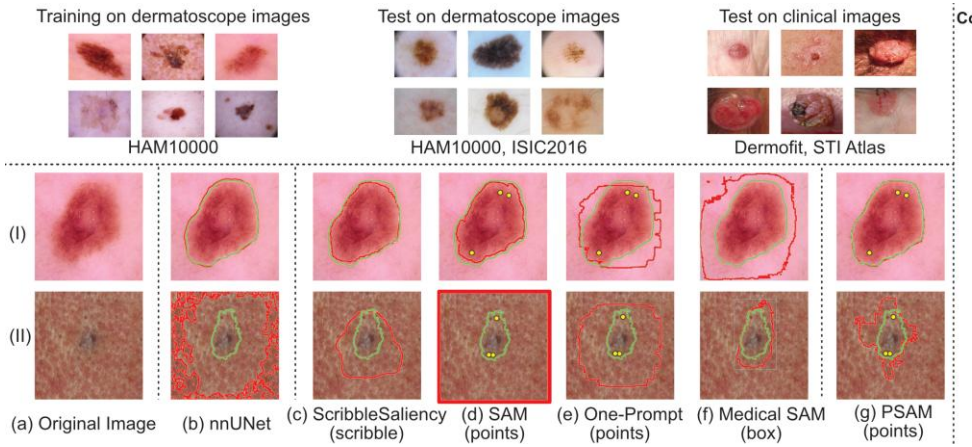
Introduces complementary point selection in uncertain regions for enhanced lesion boundary detection

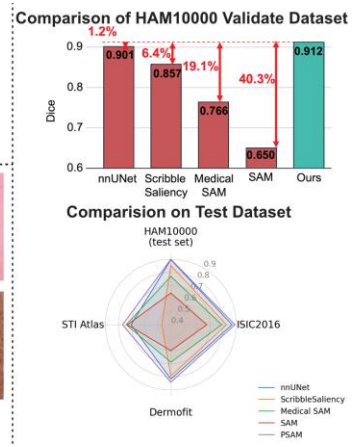
📦 Pseudo-Box Innovation

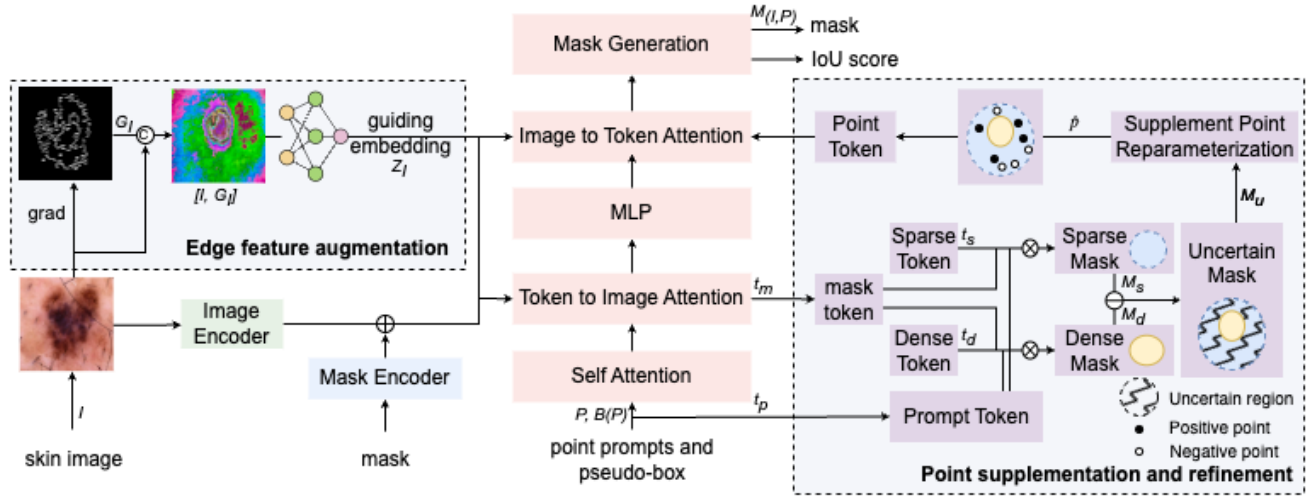
Creates intelligent pseudo-boxes from prompt points to constrain segmentation and prevent benign tissue overlap

🎨 Superior Performance

Outperforms state-of-the-art models like nnU-Net across multiple datasets (ISIC2016, STIAtlas, Dermofit) with exceptional zero-shot capabilities







Skin Automatically Segmentation

10, 000+

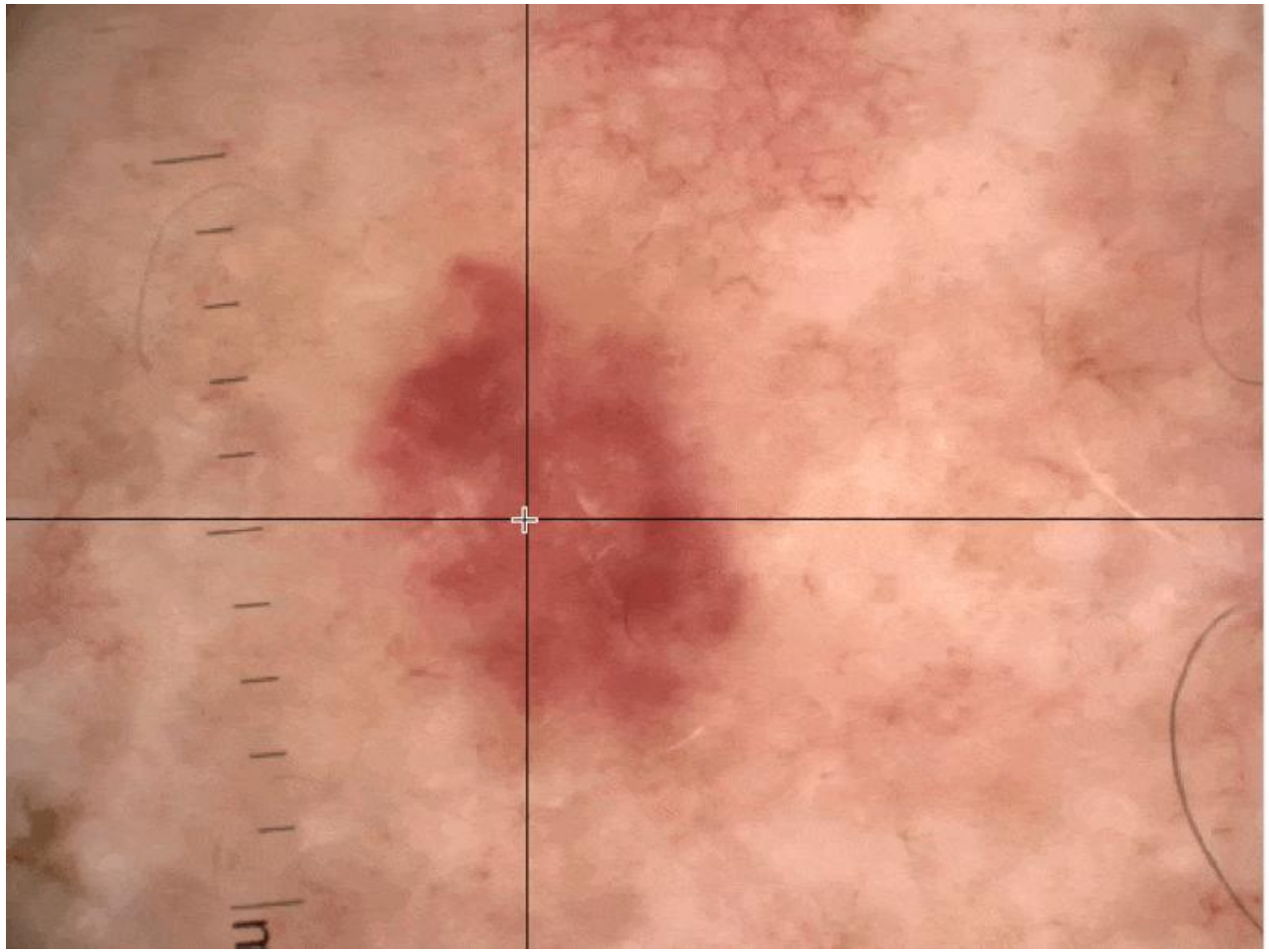
Dermatoscope Images

training on

~5s

Per Image

vs minutes manually

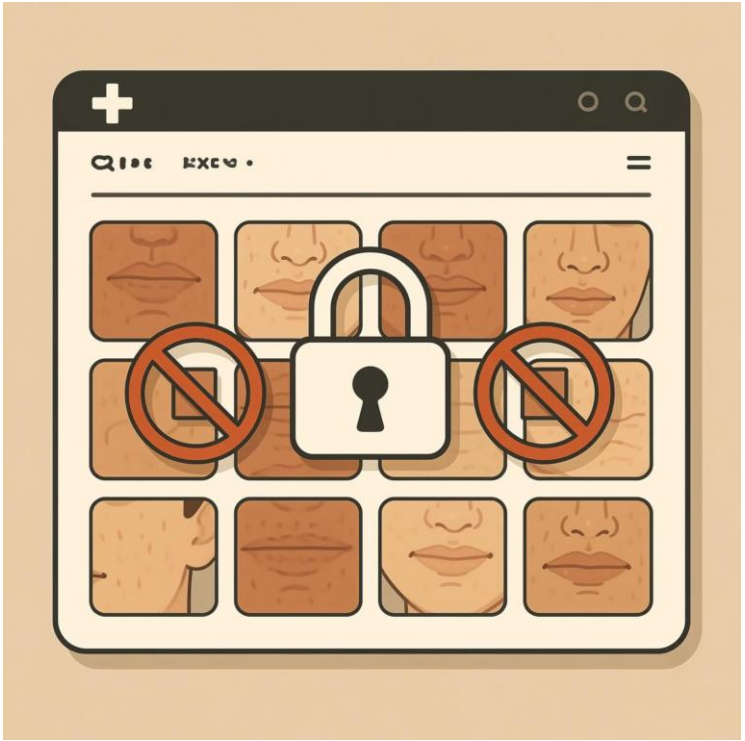


The Data Scarcity Problem

> *"Medical images/data are like gold for medical AI.*
> *The more we have, the better models we can build."*

Working from a sexual health centre presented unique challenges:

- Patient images are highly sensitive
- Privacy regulations limit data sharing
- Rare conditions have limited examples
- Diverse skin tones are underrepresented



Limited Patient Images

Privacy concerns from sexual health context

Sensitive Content

Ethical constraints on sharing

AI Needs Data

Model accuracy depends on diverse examples

Skin Generation

Beyond Art Generation

- Unlike artistic AI generation, medical image synthesis demands clinical accuracy and realistic pathology representation

Clinical Realism

- Generate images require accurate lesion textures, natural skin tones, and clinically relevant features

Privacy Protection

- Synthetic data allows us to expand the dataset without compromising patient privacy or requiring additional consent

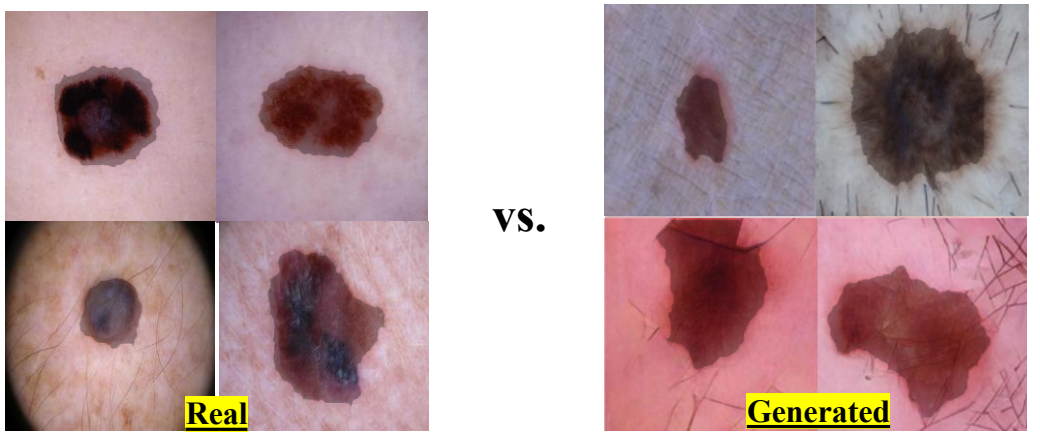


Figure 1: Comparison of Healthy Skin Regions

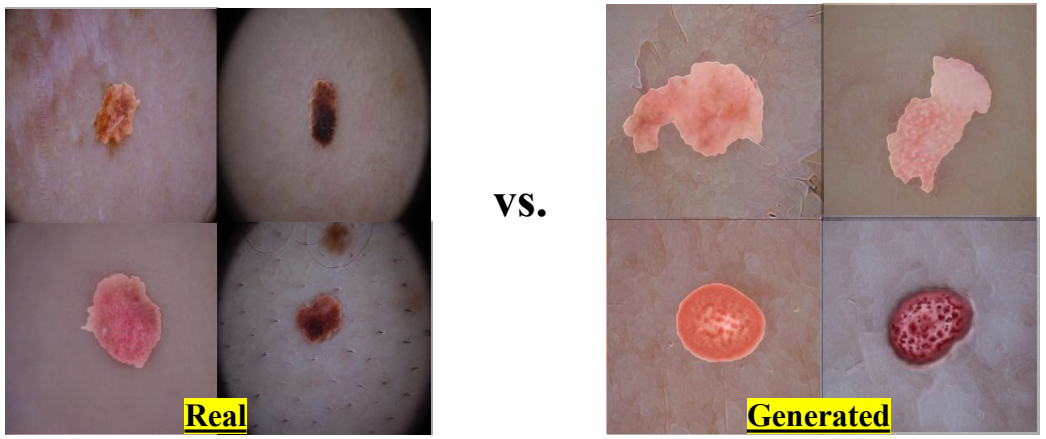


Figure 2: Limited Lesion Control Parameters Cause a Sharp Contrast

Controllable Skin Synthesis via Lesion-Focused Vector Autoregression Model

🎯 Controllable Synthesis

Generate skin images with specific lesion characteristics and locations

🔬 Lesion-Focused Design

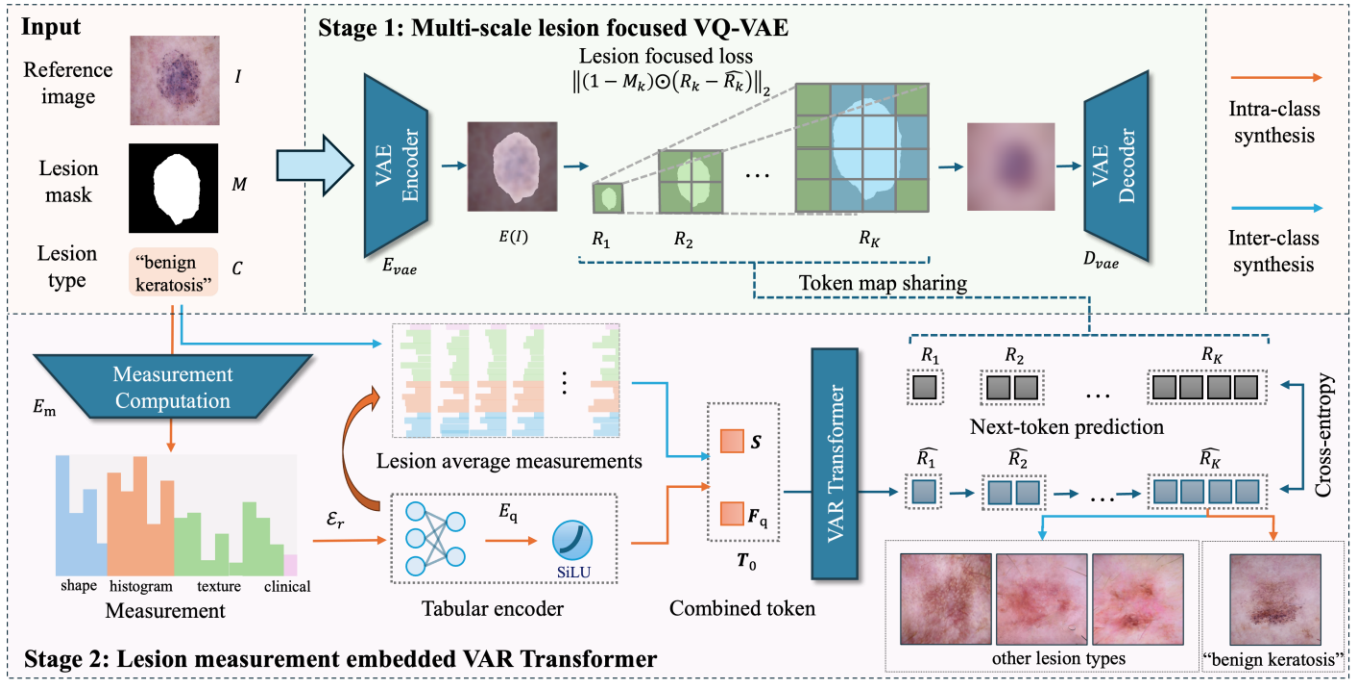
Incorporates radiomics features for enhanced clinical relevance

🎨 High Fidelity

Achieves state-of-the-art FID scores across multiple lesion types

🏥 Medical Applicability

Designed specifically for dermatological and medical imaging tasks

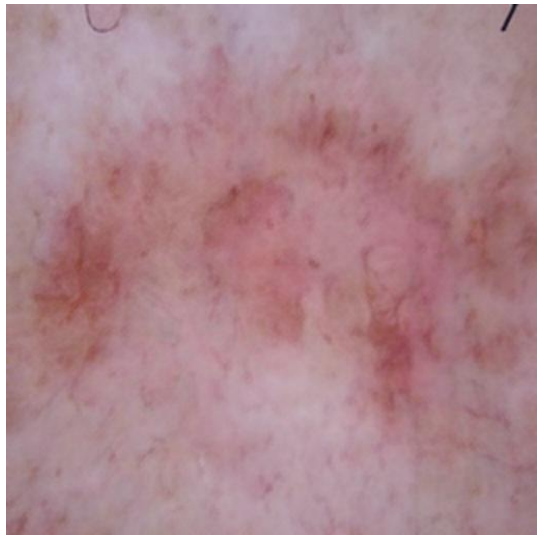
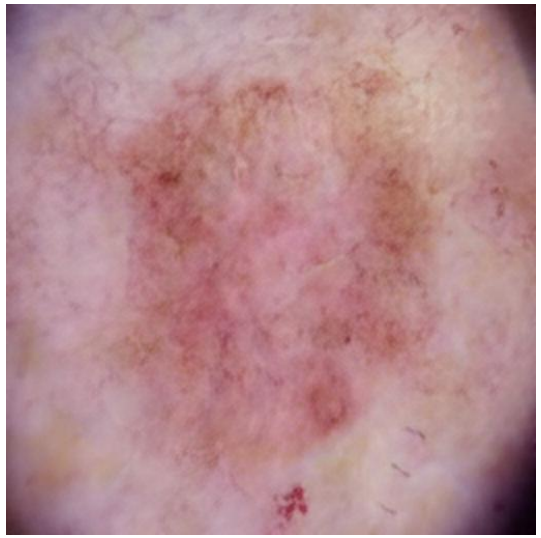
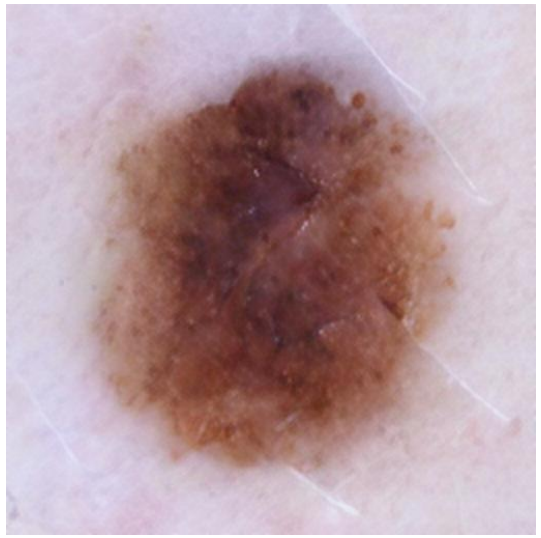
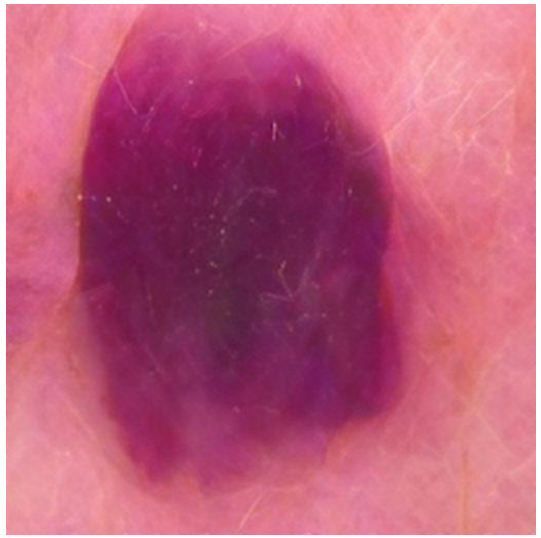
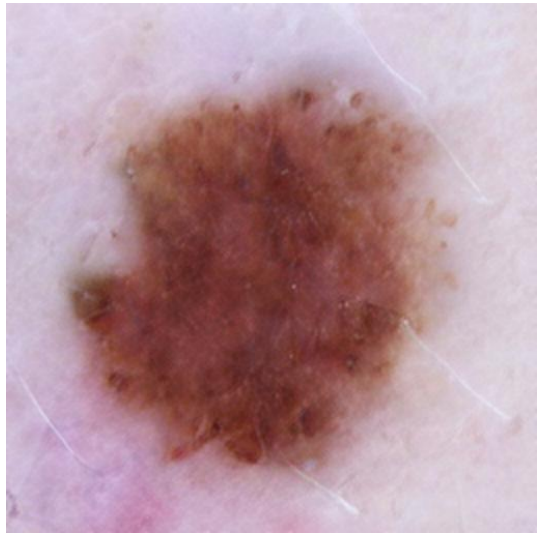
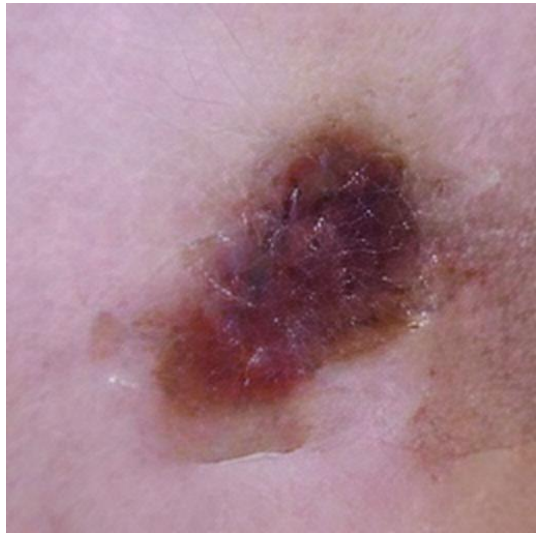


Sun, J., Yu, Z., Yan, S., Ong, J.J., Ge, Z., Zhang, L.: Controllable Skin Synthesis via Lesion-Focused Vector Autoregression Model. In: Medical Image Computing and Computer Assisted Intervention – MICCAI 2025. Lecture Notes in Computer Science. Springer, Cham (2025)

Research website: https://research.echosun.top/LF-VAR/

Visual Challenge

Can you determine which are real patient photos and which are generated by AI?

Visual Challenge Result

All Images Are AI-Generated

Clinical Implications

Training Data Expansion

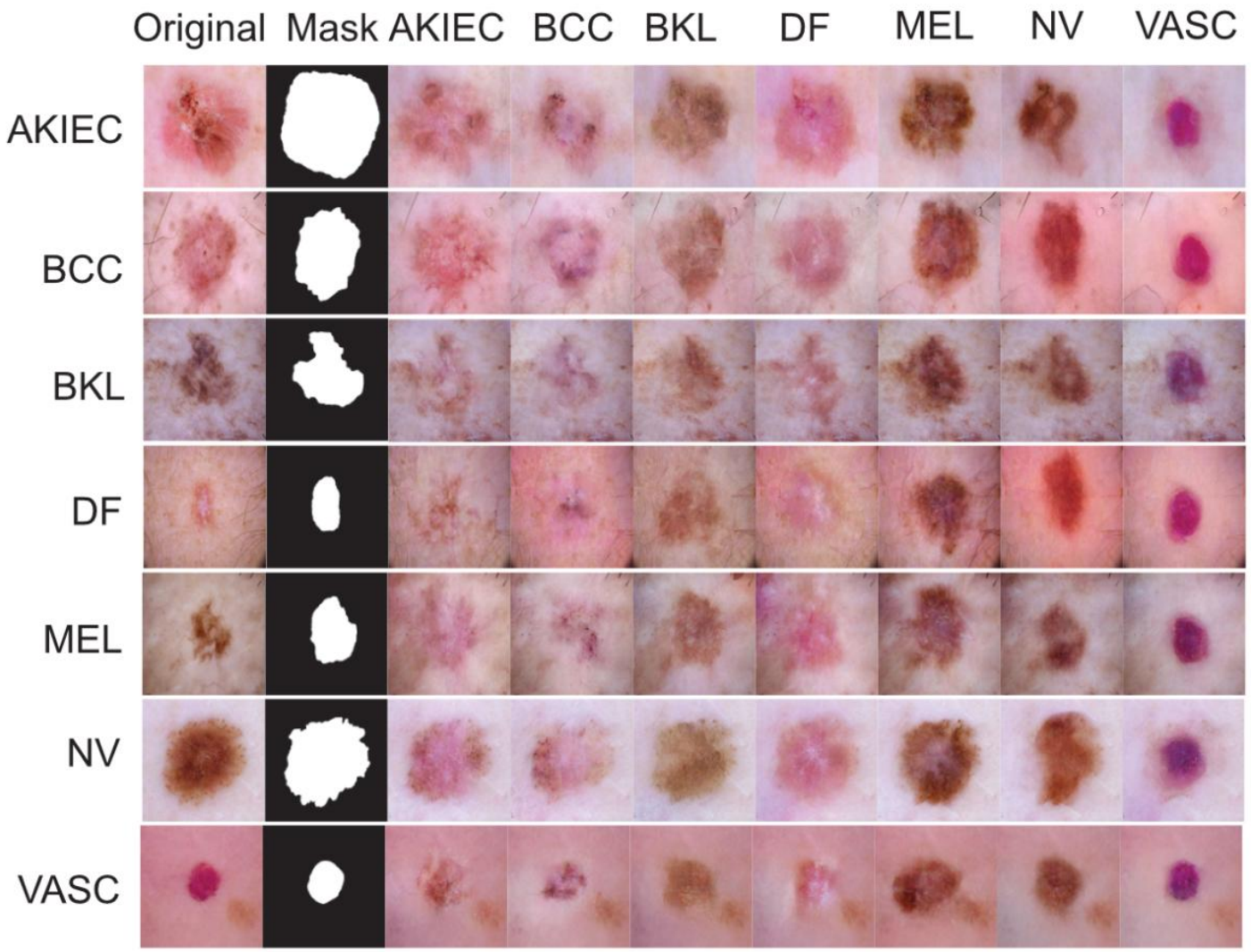
Orders of magnitude more examples

Education Tool

Teaching without patient privacy concerns

Rare Condition Modelling

Generate examples of uncommon presentations



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Thanks for watching

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