Explainable AI in Dermatology: Models and Devices to Support Clinical Practice

Clement Lenoir[1], Nuria Ferrera[1], Susana Puig[1], Sebastian Podlipnik[1], Cristina Carrera[1], Laura Serra[1], Hans Peter Soyer[2], Clare Primiero[2], Rafael Garcia[3], Sana Nazari[3], Maximilian Dreyer[4], Josep Malvehy[1]

[1]Department of Dermatology, Hospital Clinic de Barcelona, University of Barcelona, Barcelona, Spain
[2]Frazer Institute, THe University of Queensland, Dermatology Research Center, Brisbane, Australia
[3]Computer Vision and Robotics Group, University of Girona, Girona, Spain
[4]Technische Universität Berlin, Berlin, Germany

Background

Artificial intelligence (AI) has shown strong diagnostic potential in dermatology, particularly for skin cancer detection, but its clinical adoption remains limited by the "black box" nature of many algorithms. Explainable AI (XAI) aims to make model outputs more transparent, interpretable, and clinically usable.

Objective

To provide a clinician-oriented overview of XAI approaches and dermatological devices or platforms incorporating explainability-related features, with a focus on skin cancer diagnosis and imaging.

Methods

We performed a narrative synthesis of XAI methods relevant to dermatological imaging and reviewed existing or emerging systems integrating AI and XAI principles across total body photography, dermoscopy, line-field confocal optical coherence tomography, teledermatology, and multimodal diagnostic support.

Device/platform	Imaging modality and data	AI/XAI component	Intended user	Regulatory status	Main clinical value	Main limitation
ATBM Master / Moleanalyzer Pro	2D total body photography and dermoscopy	AI-assisted lesion tracking; heatmaps; automated segmentation; overlay comparison; rule-based criteria	Dermatologist	MDR Class IIa medical device software; specific scope of XAI outputs not detailed publicly.	Digital monitoring of high-risk patients and AI-supported assessment of suspicious or changing lesions.	Limited public detail on model training and XAI-output validation, despite published validation of diagnostic AI.
Vectra WB360 / DermaGraphix / DEXI	3D total body photography and dermoscopy	Pixel-for-pixel mapping; heatmaps; automated segmentation; case-based reasoning	Dermatologist	Commercial clinical/research platform; regulatory status of DEXI/XAI module not clearly documented publicly.	Digital monitoring of high-risk patients and AI-supported assessment of suspicious or changing lesions.	Limited independent validation and limited public information on DEXI training data and clinical impact.
iToBoS	3D total body photography, dermoscopy, and patient-level clinical, genetic and phenotypic data	Multimodal data integration; lesion-level and patient-level risk assessment	Dermatologist	European research project; not currently marketed as a certified clinical device.	Personalised multimodal skin cancer risk assessment combining lesion-specific and patient-level information.	Emerging system; prospective validation, regulatory certification and workflow integration remain required.
deepLive / LC-OCT AI	LC-OCT with dermoscopic co-localisation	BCC prediction score; differential scores; heatmaps; automated structural segmentation	Dermatologist	MDR Class IIa medical device; separate certification status of AI/XAI outputs not publicly specified.	Histology-like in vivo imaging with AI-supported BCC-oriented diagnostic support.	Mainly BCC-focused AI module; broader validation and clearer reporting of XAI-specific clinical utility are still needed.
SkinGPT-4	Clinical skin photographs	Vision-language model; interactive natural language explanations	Patient	Research system; not certified as a clinical medical device.	Patient-friendly textual explanations and support for triage, patient understanding and patient-doctor communication.	Risk of inaccurate explanations or recommendations; no clinical certification or real-world deployment validation.
DermEngine Visual Search	Dermoscopic images	Case-based reasoning / similar-case retrieval	Dermatologist	Commercial dermatology platform; regulatory status of Visual Search/XAI component not clearly documented publicly.	Retrieval of visually similar cases to support comparative diagnostic reasoning.	Depends on database quality and labelling; similar-case retrieval does not prove causal reasoning or model validity.
SkinDoc	Smartphone clinical photographs / teledermatology	Heatmaps; automated segmentation; textual explanations	Patient	Research/prototype teledermatology application; not certified as a clinical medical device.	Patient-facing interpretability and teledermatology-oriented AI support.	Limited published validation, unclear training details and risk of patient misinterpretation without medical oversight.

Table 1. Existing and emerging dermatological devices and platforms incorporating AI/XAI-related features

Results

XAI methods in dermatology include saliency maps and heatmaps, pixel-for-pixel mapping, automated segmentation, feature attribution, attention mechanisms, case-based reasoning, prototype- and concept-driven models, rule-based approaches, counterfactual explanations, natural language models, and multimodal systems. Several platforms already incorporate such principles, including ATBM Master/Moleanalyzer Pro, Vectra WB360/DermaGraphix/DEXI, iToBoS, deepLive, SkinGPT-4, DermEngine Visual Search, and SkinDoc. These tools may support lesion tracking, risk scoring, visual explanation, case comparison, histology-like image interpretation, and patient-facing assessment. However, their implementation is limited by insufficient prospective validation, variable transparency regarding AI and XAI components, incomplete integration of multimodal patient data, and limited clinician training.

Conclusion

XAI has the potential to make AI-assisted dermatology more transparent, verifiable, and clinically meaningful. Its successful adoption will require robust real-world validation, standardised evaluation frameworks, clear developer reporting, and active dermatologist involvement throughout design, assessment, and implementation.