









# DermaCon-IN: A Multi-concept Annotated Dermatological Image Dataset of Indian Skin Disorders for Clinical AI Research

Shanawaj S Madarkar, Mahajabeen Madarkar, Madhumitha Venkatesh, Teli Prakash, Konda Reddy Mopuri, Vinaykumar MV, KVL Sathwika, Adarsh Kasturi, Gandla Dilip Raj, PVN Supranitha, Harsh Udai

Indian Institute of Technology Hyderabad. Indian Navy. Madarkar Hospital, India S R Patil Medical College, India. S Nijalingappa Medical College, India Sri Chamundeshwari Medical College, Hospital & Research, India





#### DermaCon-In Dataset

DermaCon-IN sample images











Descriptors	Patch, White	Fissure, Hyperkeratotic	Erythema,	Erythema, Wheal	Patch, Plaque, White					
*	(Hypopigmentation)	plaques, Scale	Plaque, Scale		(Hypopigmentation)					
	Upper Extremities Hands		Head Cheeks	Trunk Abdomen, Thorax,	Head Scalp					
	(Manus) Fingers (Digits)	(Plantar Region)	2	Upper Extremities Shoulders						
Main Class	Pigmentary Disorders	Keratanisation Disorders	Infectious Disorders	Inflammatory Disorders	Inflammatory Disorders					
Sub Class	Pigmentary Disorders	Keratanisation Disorders	Infectious-Fungal	Inflammatory (Other)	Eczema and Dermatitis					
Disease Label	Vitiligo	Palmoplantar Keratoderma	Tinea Faciei	Urticaria	Seborrheic Dermatitis					

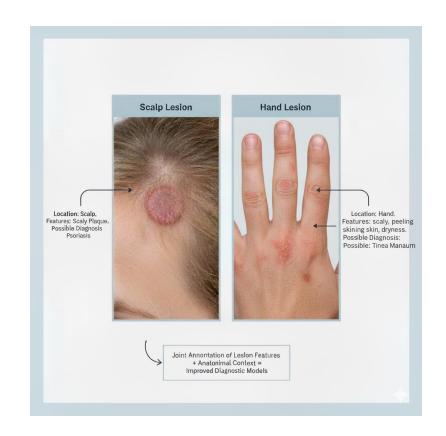
- First prospectively curated dermatology dataset
- 5,450+ clinical images from ~3,000 South Indian patients,
- 240+ diagnosis
- Clinically Hierarchical labels as per Rook's Taxonomy
- 47 lesion-level concepts, 49 body locations, and 6 FST and 10 MST skin tone scores





# Context Matters: Dermatological Diagnosis

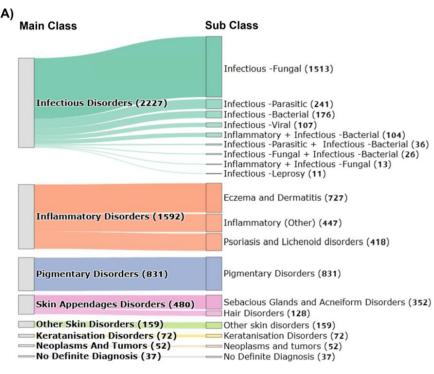
- Location Matters in Diagnosis
- **Scalp:** Scaly plaque → Psoriasis
- **Hand:** Scaly, peeling skin → Tinea Manuum
- **Dermatologists:** Features + Anatomy = Diagnosis
- **Better Models:** Joint Annotation = Improved Accuracy

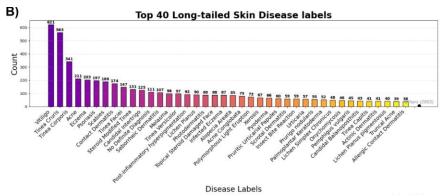






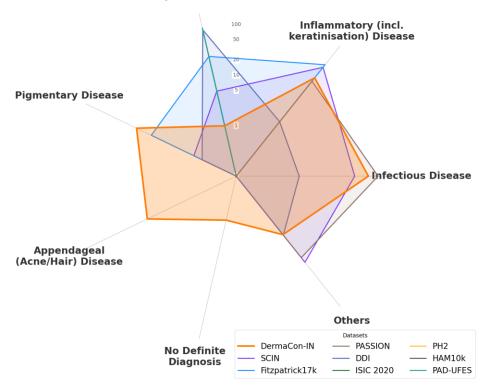
#### Hierarchical Labels





#### **Dermatological Disease Spread Across Datasets**

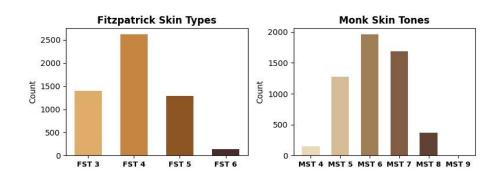


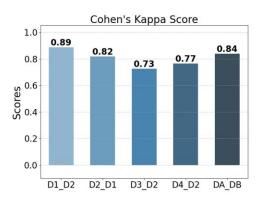


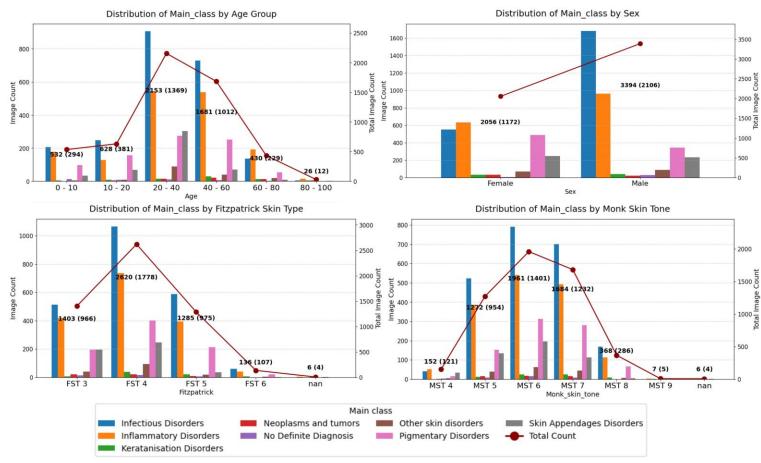




#### **Data Statistics**



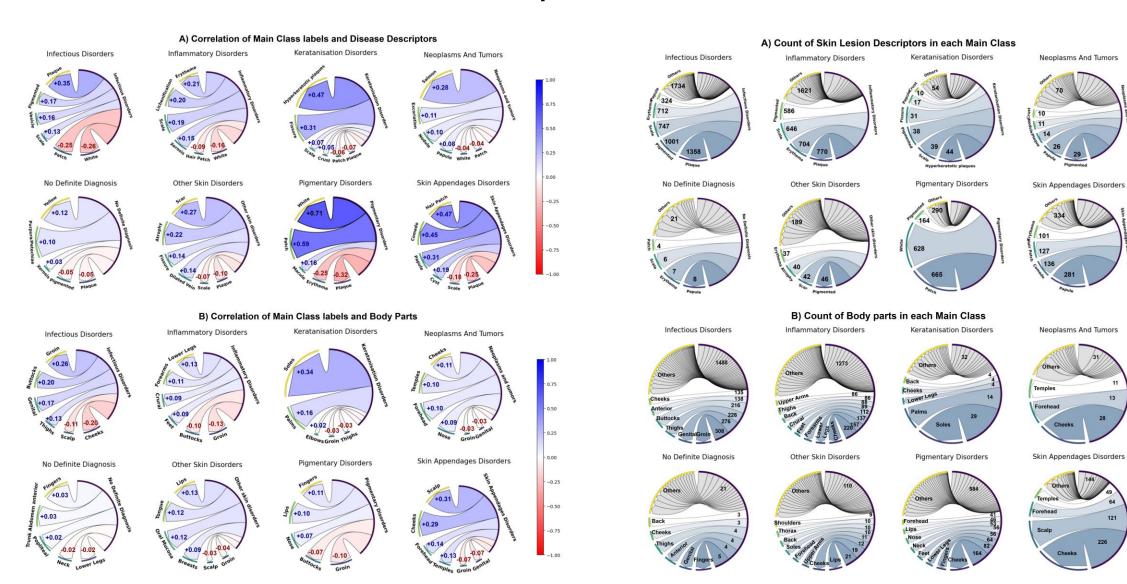






## **Concept Statistics**



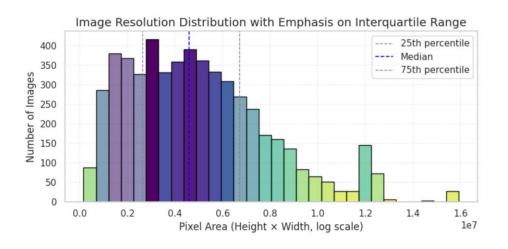






# Challenges and Opportunities

- Resolution heterogeneity
- Long-tailed Disease Labels
- Class-agnostic Concept semantics
- Hierarchical Class Label
- Multi-disease co-occurrence analysis:
  - Misclassifications collapse to one constituent disease (Either)
  - O Suggestive of one pathology's cues often dominate the visual evidence

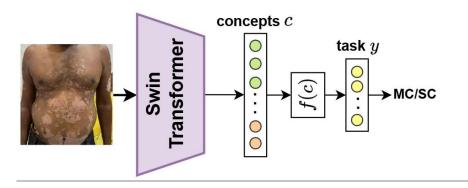






### **CBM Benchmarks Architecture**

#### A) Concept Bottleneck Model for 1-level classification



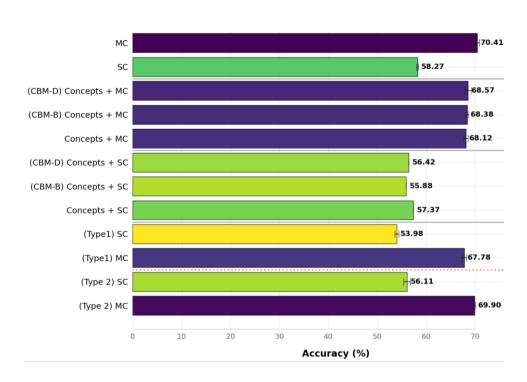
○ Body part concept ○ Lesion descriptor concept ○ Output logits

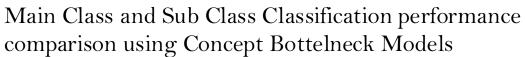
#### B) Concept Bottleneck Model for 2-level hierarchical classification Type 1: concepts task task **Transformer** Swin task y1Type 2: concepts → SC 0 **Transformer** Swin ${\rm task}\;y2$

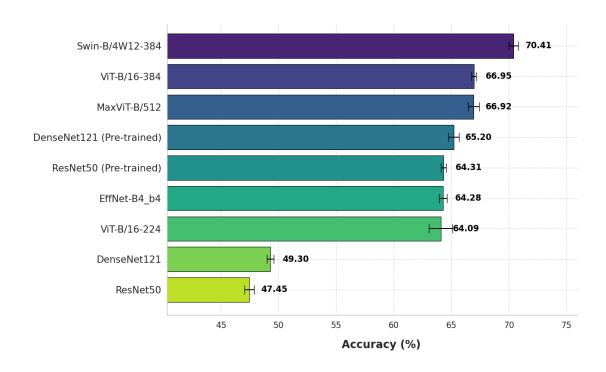




# Comparative Results of Benchmarks with CBMs and other standard architectures





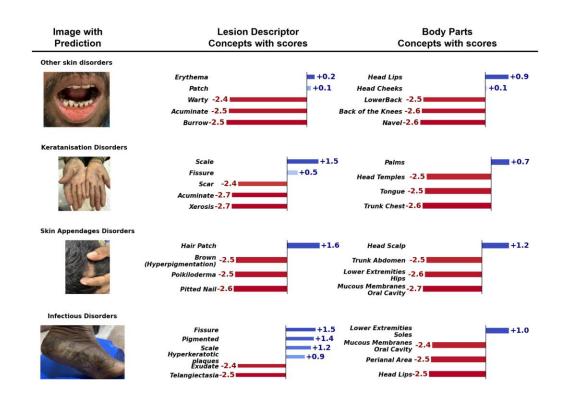


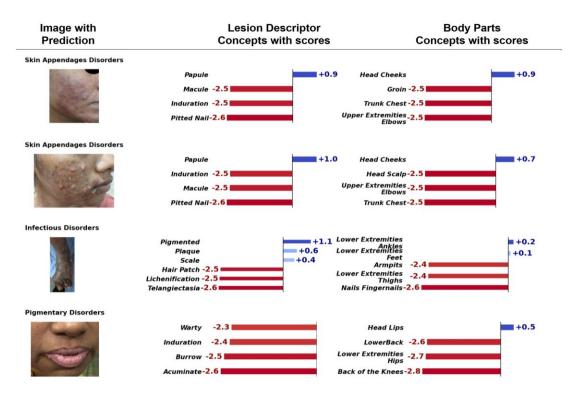
Main Class Classification performance comparison across Various Architectures





# **Concept Analysis**

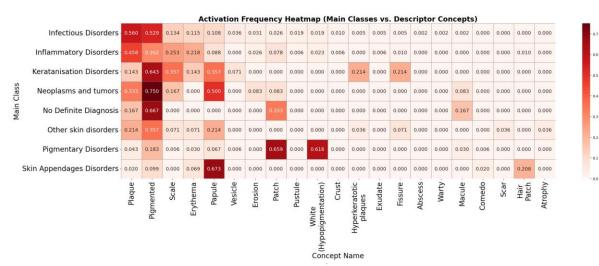




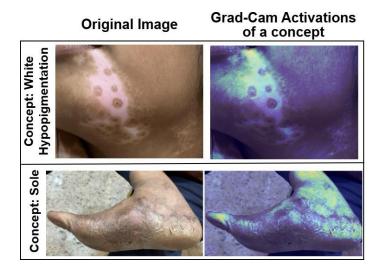


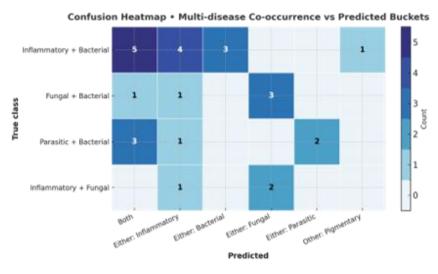


# More Analysis



					Activati	ion Fred	uency	Heatm	ар (Ма	in Class	ses vs.	Body P	arts C	ncepts	)		
	Infectious Disorders	0.050	0.029	0.010	0.007	0.005	0.002	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Inflammatory Disorders	0.006	0.078	0.003	0.003	0.010	0.000	0.013	0.003	0.003	0.000	0.000	0.003	0.006	0.000	0.003	0.003
	Keratanisation Disorders	0.000	0.214	0.000	0.000	0.143	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Class	Neoplasms and tumors	0.000	0.500	0.000	0.000	0.000	0.000	0.083	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Main Class	No Definite Diagnosis	0.000	0.167	0.000	0.000	0.000	0.000	0.000	0.167	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
_	Other skin disorders	0.071	0.107	0.000	0.000	0.107	0.000	0.000	0.000	0.000	0.000	0.000	0.036	0.000	0.000	0.000	0.000
	Pigmentary Disorders	0.006	0.152	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.012	0.006	0.006	0.000	0.000	0.000	0.000
5	kin Appendages Disorders	0.010	0.624	0.000	0.000	0.000	0.000	0.218	0.010	0.000	0.010	0.000	0.000	0.000	0.010	0.000	0.000
		Genital Area (Pubic Region)  Head Cheeks Upper Extremities (Natus) (Didits) (Didits) (Didits) (Didits) (Extremities Feet (Pedal Region) Rose (Plantar Retermities Soles (Plantar Region)		Lower Extremities Soles (Plantar Region)	Lower Extremities - Lower Legs	Head Scalp	Lower Extremities Thighs (Femoral Region) Lower Extremities Ankles (Tarsall Region) Region)		Head Nose	Groin (Inguinal- Region)	Head Lips	Upper Extremities Forearms (Antebrachium)	Upper Extremities - Elbows	Trunk Abdomen anterior	Palms		









DermaCon-In is hosted in **Harvard Dataverse!** 





**GITHUB** 



**CONTACT** 



## THANK YOU