SAGAlyze — Clinician-Only Smart Dermatology Assistant

Transforming dermatologic care through intelligent progress tracking, fairness-driven AI assistance, and controlled patient communication.

Core Philosophy: Human-Centered AI in Dermatology

At SAGAlyze, we believe that artificial intelligence should augment, not replace, the profound expertise and compassionate judgment of dermatologists. Our platform is meticulously designed to empower clinicians, providing intelligent insights that enhance diagnostic accuracy and treatment efficacy, while always placing the patient-physician relationship at its core. This philosophy is encapsulated in two guiding principles:

AI assists — dermatologist decides.

Our AI provides data-driven support, helping identify subtle patterns and track progress. The ultimate diagnostic and treatment decisions, however, remain firmly in the hands of the clinician, leveraging their invaluable experience and understanding of each unique patient.

AI interprets pixels; physicians interpret patients.

While SAGAlyze excels at analyzing visual data from lesions, we recognize that a patient's overall health, history, and personal context are paramount. The AI handles the intricate patterns of pixels, but it is the physician who interprets the patient as a whole, ensuring comprehensive and empathetic care.

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The Critical Challenge in Dermatology Today

Patient Experience Challenges

Dermatologic conditions commonly take weeks or months to improve, creating significant challenges for both patients and clinicians. Most patients struggle profoundly to judge the severity of their condition objectively, often failing to notice small but clinically meaningful improvements over time. This perception gap frequently leads to anxiety, dissatisfaction, and poor treatment adherence.

The situation has become more complex with the proliferation of generic AI models. Increasingly, patients are uploading skin condition photographs to platforms like ChatGPT for instant feedback, creating dangerous scenarios of false reassurance, panic from false positives, unsupervised self-treatment, and critically delayed proper medical care.

Clinical Impact

These challenges create cascading effects throughout the healthcare system. Patients frequently switch providers out of frustration, reducing continuity of care and clinic footfall. Healthcare providers face increased medico-legal exposure from patients acting on unverified AI recommendations, whilst clinicians lack objective tools to demonstrate improvement to anxious patients.

The fundamental principle remains unchanged: any AI-assisted dermatology system must not be patient-operated, and all diagnostic and therapeutic interpretation must remain firmly with qualified clinicians.

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Core Solution Architecture

Clinician-Only Access

Secure authentication system restricted exclusively to licensed dermatologists and qualified clinicians. Comprehensive access to capture, analyze, and track patient progress longitudinally.

AI-Assisted Classification

On-device machine learning model performing offline classification of 5–7 common dermatologic presentations with calibrated confidence scores and explainability highlights.

Progress Tracking

Longitudinal monitoring across multiple visits with sophisticated visualization of subtle improvements in lesion area, redness, pigmentation, and patch characteristics.

Controlled Sharing

Curated, read-only progress summaries that clinicians can share with patients, containing visual improvements without diagnostic interpretations or AI outputs.

This architecture ensures that clinician judgment prevails at every decision point, whilst providing powerful AI-assisted support for objective assessment and patient communication.

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AI Classification System — Technical Specifications

Supported Conditions

The system detects 5–7 common dermatologic presentations:

- **Acne** — inflammatory and non-inflammatory lesions
- **Eczema/Dermatitis** — atopic and contact variants
- **Tinea/Fungal infections** — superficial mycoses
- **Vitiligo** — depigmentation patterns
- **Benign nevus** — common melanocytic nevi
- **Suspicious-lesion category** — requiring further investigation

Clinical Output Framework

For each analyzed image, the system provides clinicians with comprehensive decision-support information presented in an intuitive interface:

Top-3 predictions with differential likelihood ranking

Calibrated confidence scores reflecting true probability estimates

Risk band classification (low/medium/high) for clinical prioritization

Explainability highlights showing which image regions influenced the model's assessment

Every screen displays a prominent disclaimer: "This is an AI-assisted advisory tool; clinician judgment prevails."

Performance Requirements

<35MB	<300ms	100%
Model Size	Inference Time	Offline-First
Optimized for on-device deployment	Real-time analysis capability	No internet dependency for core functions

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Fairness, Transparency & Model Accountability

Addressing algorithmic bias in medical AI is not optional — it's a fundamental ethical and clinical requirement. SAGAlyze embeds comprehensive fairness auditing and transparency mechanisms throughout the system.

Model Card Components

Every deployed model includes a detailed, accessible model card providing clinicians with critical performance context:

- **Performance stratification by skin tone** — detailed accuracy metrics across Fitzpatrick phototypes I through VI, exposing any performance disparities across diverse patient populations
- **Expected Calibration Error (ECE)** — quantifying how well the model's confidence scores match actual correctness rates
- **Confusion matrices** — revealing specific misclassification patterns and common diagnostic confusions
- **Limitations documentation** — clearly articulating known weaknesses, edge cases, and appropriate use contexts
- **Training data demographics** — transparency about representation in development datasets

Continuous Monitoring

The system implements ongoing fairness monitoring to detect performance drift or emerging biases in real-world deployment:

Demographic performance tracking: Regular analysis of prediction accuracy across patient subgroups to identify disparities

Calibration monitoring: Continuous assessment of confidence score reliability across diverse presentations

Error pattern analysis: Systematic review of misclassifications to identify systematic biases

All fairness metrics are accessible to clinicians through the application interface, empowering informed clinical decision-making with full awareness of model limitations.

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Longitudinal Progress Tracking & Visualization

The cornerstone of SAGAlyze is its sophisticated ability to objectively quantify and visualize dermatologic improvement over time — transforming subjective assessments into data-driven patient conversations.

Day 0 — Baseline

Initial capture with automated cropping, alignment, and normalization establishing the reference state

1

Week 2 — Follow-up

Second capture with intelligent registration to baseline, enabling precise pixel-level comparison

2

Week 4 — Assessment

Continued tracking with cumulative analysis revealing trends and treatment response patterns

3

Week 8 — Outcome

Comprehensive longitudinal view demonstrating treatment efficacy through objective metrics

4

Tracked Clinical Parameters

Lesion Area

Precise measurement of affected surface area using segmentation algorithms, with percentage change calculations

Redness Index

Quantification of erythema intensity through colorimetric analysis of RGB values in affected regions

Pigmentation

Assessment of hyper- or hypopigmentation changes using standardized chromatic measurements

Patch Characteristics

Monitoring of lesion number, size distribution, and morphological features over treatment course

Visualization Tools

Heatmap Deltas

Color-coded overlays showing regions of improvement (green), stability (yellow), or concern (red) across the treatment area

Before–After Slider

Interactive comparison tool allowing clinicians to drag between baseline and current states for dramatic visualization

Zoom Crop Comparison

Side-by-side detailed views of specific regions of interest for precise assessment of subtle changes

Time-Lapse Animation

Automated video generation showing progression across all captured timepoints for powerful patient communication

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Controlled Patient Progress Sharing Framework

A revolutionary approach to patient communication that maintains clinical control whilst empowering patients with visual evidence of improvement.

Clinician Curation Process

The clinician maintains complete control over what information reaches the patient through a sophisticated curation workflow:

1. **Review progress visualizations** — clinician examines all generated comparisons, heatmaps, and metrics within the application
2. **Select appropriate views** — choose which before/after comparisons, time-lapses, or trend graphs are most appropriate for the specific patient
3. **Add contextual notes** — include simple, non-diagnostic commentary like "Improvement noted since last visit" or "Continue current treatment plan"
4. **Approve for sharing** — explicit confirmation step before any information leaves the clinical system
5. **Generate secure delivery** — system creates PDF or secure link/QR code for patient access

Patient View Restrictions

✅ **Permitted Content:**

- Before/after visual comparisons
- Overlay heatmaps
- Time-lapse animations
- Simple trend indicators (e.g., "inflammation ↓ 18%")
- Clinician-approved notes

❌ **Prohibited Content:**

- Condition names or diagnoses
- Differential diagnosis lists
- Risk scores or classifications
- AI model interpretations
- Treatment recommendations

Technical Implementation

Patient-facing summaries are delivered through secure, read-only mechanisms ensuring no possibility of modification or misinterpretation. The system uses cryptographically signed links with expiration dates and access logging, ensuring full audit trails whilst protecting patient privacy and maintaining HIPAA compliance throughout the sharing workflow.

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Complete User Journey — Clinician Workflow

SAGAlyze streamlines the entire clinical process, from initial patient consultation to secure progress sharing, integrating AI insights at key decision points for enhanced efficiency and patient care.

Login

Secure access to the SAGAlyze platform.

Patient List

Access and manage comprehensive patient records.

Select Patient

Choose the specific patient for the current visit.

Capture Image

High-resolution image acquisition with guided framing.

AI Analysis

Classification, confidence scores, and explainability insights.

Clinician Interpretation

Review and confirm AI findings with medical expertise.

Save Visit

Document and store all visit details securely.

Follow-up Visit

New image capture for ongoing patient monitoring.

Progress Compare

Visual comparison tools: heatmaps, time-lapses, metrics.

Clinician Review

Evaluate treatment efficacy and patient progress.

Generate Summary

Automated creation of patient-friendly progress reports.

Share Progress

Curate, approve, and securely share reports via link/PDF.

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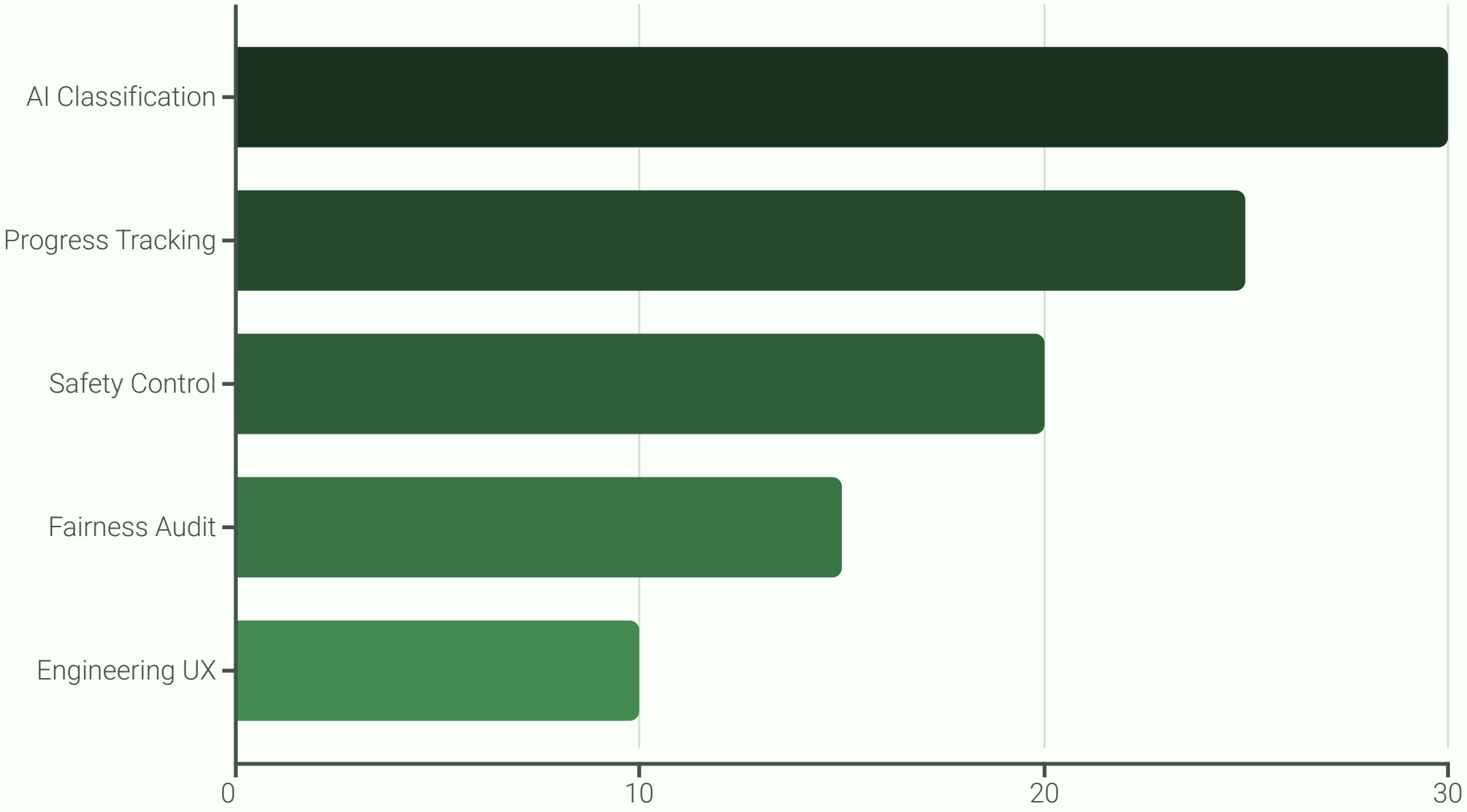
Evaluation Framework & Success Metrics

SAGAlyze will be assessed through a comprehensive, weighted evaluation rubric ensuring balance across technical excellence, clinical utility, and ethical considerations.



AI Classification

30% Weight

- Model accuracy across conditions
- Calibration quality (ECE)
- Inference speed
- Model size optimization
- Explainability clarity

Progress Tracking

25% Weight

- Visualization quality and intuitiveness
- Metric accuracy and clinical relevance
- Longitudinal data management
- Comparison tool usability

Safety Control

20% Weight

- Clinician-only access enforcement
- Patient view restrictions
- Disclaimer prominence
- Audit trail completeness

Fairness Audit

15% Weight

- Model card completeness
- Performance equity across skin tones
- Bias documentation
- Limitation transparency

Engineering & UX

10% Weight

- Code quality and architecture
- Interface intuitiveness
- Performance optimization
- Documentation quality

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Example Patient Summary (What They Might See)

Your Progress (Day 0 → Day 15)

This summary provides a concise overview of your treatment progress, highlighting visual changes and key metric improvements since your last visit.

Visual Progress Overview

- Before-and-after comparison images
- Detailed zoomed-in crop views
- Color-coded improvement heatmap

Key Metric Changes

14%

Redness index reduced

9%

Pigmentation lightened

18%

Lesion size decreased

Clinician's Note

> "You are responding well. Continue current regimen. Next review in 15 days."

Important Disclaimer

This is ONLY a visual tracking summary for your information. Please consult your clinician for any interpretation, diagnosis, or treatment decisions. This summary does not include condition names, risk scores, or AI-generated messages.

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SAGAlyze UI Model: Clinician vs. Patient

SAGAlyze is designed with two distinct user interfaces, each tailored to the specific needs and permissions of clinicians and patients, ensuring data integrity and appropriate information flow.

Clinician App

- **Full Functionality:** Comprehensive access to all features, including advanced analytics and patient management tools.
- **Storage of Comparisons:** Ability to store, retrieve, and manage all longitudinal comparison data.
- **Local Inference:** Supports on-device AI model inference for faster insights and enhanced privacy.
- **Full Metrics:** Access to detailed quantitative metrics for precise progress tracking and evaluation.
- **Controls What to Share:** Clinicians retain full control over which data and insights are shared with patients.

Patient Viewer

- **Minimal & Read-Only:** Streamlined interface focused solely on presenting approved progress summaries.
- **Summary Only:** Displays only curated progress visuals and clinician notes, with no raw data or complex charts.
- **No Retake / Self-Capture:** Patients cannot upload new images or manipulate existing data, ensuring clinical control.
- **No Diagnosis Text:** Strictly prohibits the display of medical diagnoses or condition names.
- **No Classifier Output:** AI model interpretations or confidence scores are never exposed to patients.

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Technical Stack Recommendation

Our proposed technical stack and development approach are designed to build a robust, scalable, and clinically effective SAGAlyze platform.

AI Model Selection

Leveraging efficient, mobile-optimised models like MobileNetV3-Small or EfficientNet-Lite, converted to TFLite or Core ML for on-device inference.

Confidence Calibration

Implementing temperature scaling or isotonic regression to ensure accurate and reliable classifier confidence scores for clinical interpretation.

Advanced Image Processing

Utilising OpenCV or Skia for precise image alignment, normalisation, and dynamic heatmap overlays to enhance visual diagnostics.

App Development Framework

Developing the application on Android (Kotlin + Jetpack Compose) or using Flutter for cross-platform compatibility with integrated TFLite.

Comprehensive Dataset Strategy

Curating public dermatology image sets (e.g., HAM10000, DermNet) and employing synthetic augmentation for diverse lighting and skin tone representation.

Intuitive UI/UX Design

Prioritising a minimal and clean user flow: Capture → Classify → Track → Share, ensuring ease of use for clinicians.

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Deliverables

Transform this vision into reality through systematic development and comprehensive documentation.

1

Code Repository

Complete, well-documented source code hosted on GitHub with clear README, installation instructions, architecture documentation, and comprehensive inline comments. Include dependency management, version control best practices, and contribution guidelines.

2

Mobile Application

Production-ready cross-platform application (Android/iOS) or native implementations with polished UI/UX, optimized performance, offline-first architecture, and comprehensive error handling. Include installation packages and deployment documentation.

3

AI Model Package

Trained and optimized TensorFlow Lite or Core ML model meeting size (<35MB) and speed (<300ms) requirements, with training scripts, model architecture documentation, performance benchmarks, and fairness evaluation results.

4

Progress Comparison Module

Fully functional longitudinal tracking system with image registration, metric calculation, visualization generation, and comparison tools. Include algorithm documentation and validation against ground truth measurements.

5

Patient Summary System

Complete implementation of controlled sharing mechanism with PDF generation, secure link creation, access control enforcement, and audit logging. Demonstrate compliance with privacy requirements and clinical safety standards.

6

Model Card & Fairness Audit

Comprehensive model documentation including performance stratification by Fitzpatrick skin type, calibration analysis, confusion matrices, bias assessment, limitation documentation, and recommendations for appropriate use contexts.

7

Demonstration Video

Professional 5–7 minute video showcasing complete user journeys for both clinician workflow and patient summary viewing, highlighting key features, safety mechanisms, and clinical value proposition. Include voiceover narration and on-screen text.

Let's Build the Future of Dermatologic Care

SAGAlyze represents a paradigm shift in how we approach AI-assisted dermatology — prioritizing clinician control, patient safety, and algorithmic fairness whilst delivering unprecedented objective progress visualization. This is your opportunity to create a system that genuinely improves patient outcomes, strengthens the clinician-patient relationship, and sets new standards for responsible medical AI deployment.

Together, we can demonstrate that sophisticated AI assistance and rigorous clinical oversight are not opposing forces — they're complementary elements of exceptional patient care.

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