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FACE IMAGE QUALITY WORKSHOP

Optimizing Face Quality Metrics for Robust Liveness Detection

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November 2023

Introduction

- *Optimized face quality metrics are the cornerstone of reliable and transparent liveness detection*

- *Liveness is more than just an algorithm - it's holistic system where quality metrics play a pivotal role.*

Agenda

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1. Introduction to Face Quality Metrics
2. Challenges in Liveness Detection
3. The Interplay of Liveness and Quality
4. Optimizing Quality Metrics - Approach
5. Feature Engineering
6. Machine learning
7. Results
8. Benefits of Mutual Optimization
9. Conclusion & Future

Introduction to Face Quality Metrics

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- Quality Metrics: Your Virtual Assistant for facial image suitability
- Purpose: Understand and explain liveness algorithm behaviour.
- Real-world Challenges: Reflections, lighting, angles, expressions, occlusions…
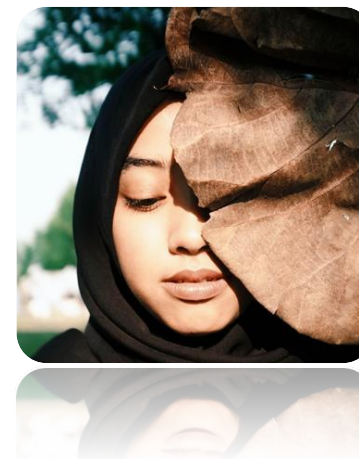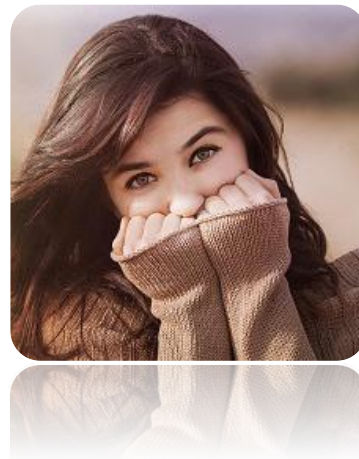
Challenges in Liveness Detection

- Liveness: Authenticating real, live subjects.
- Decoupling liveness performance into Vulnerability and User Experience metrics
- Quality's Role: (Virtual Assistant) Diagnosing why and when liveness algorithm might fail.
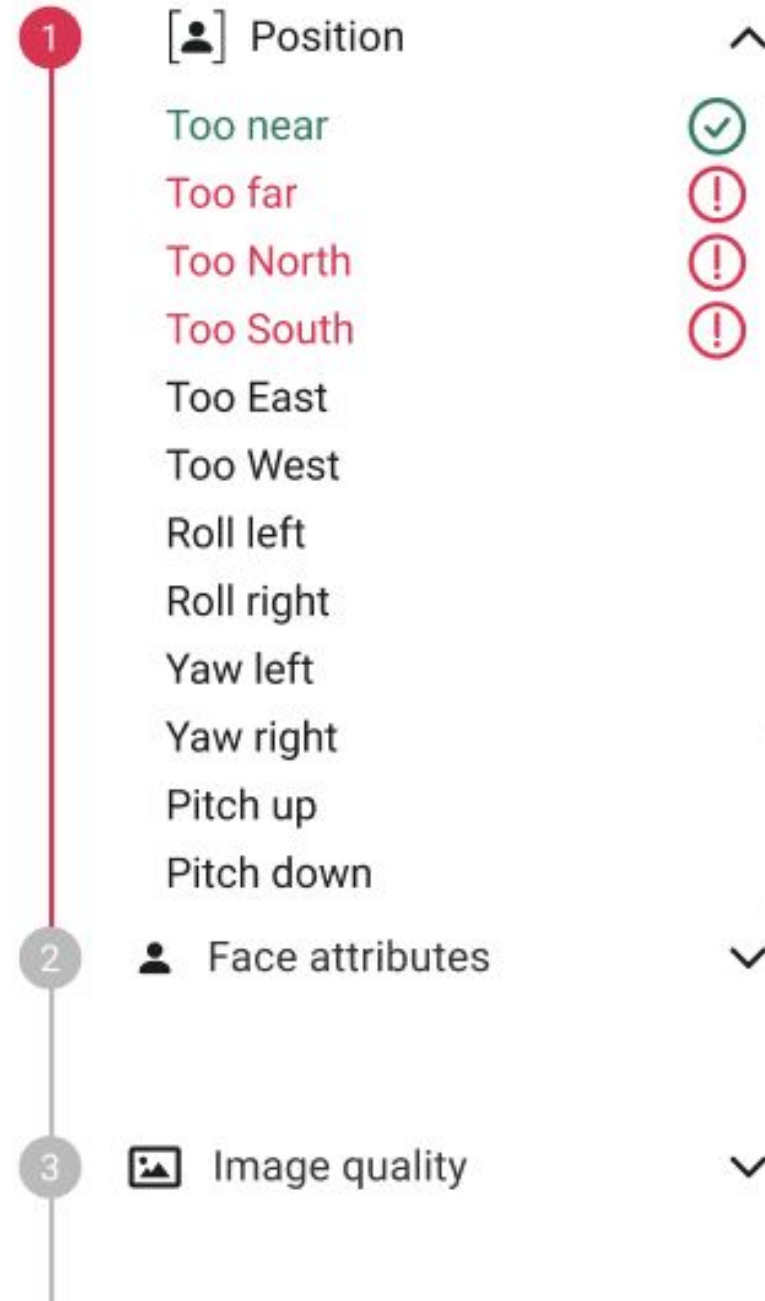
The Interplay of Liveness and Quality

- **Traditional Metrics' Shortcomings**: Not comprehensive for explaining liveness behaviour
- **Need for Better Explainability**: Ensuring users understand authentication outcomes.
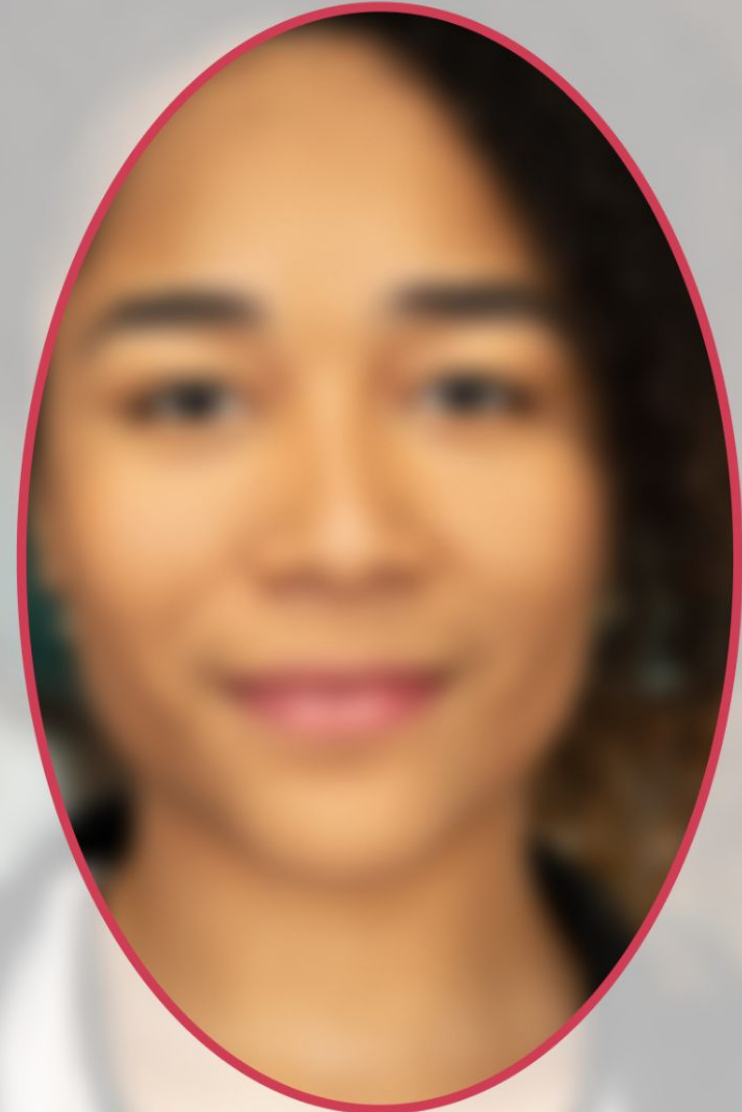
The Interplay of Liveness and Quality

- **Stable User Experience**: Providing consistent and reliable results for users
- **Demand For Metrics (Virtual Assistant):** Diagnosing and Predicting liveness robustness

ICAO status

1 [👤] Position ⌃
- Too near ✓
- Too far ⊘
- Too North ⊘
- Too South ⊘
- Too East
- Too West
- Roll left
- Roll right
- Yaw left
- Yaw right
- Pitch up
- Pitch down

2 👤 Face attributes ⌄

3 🖼 Image quality ⌄

Optimizing Quality Metrics - Approach

- **Data Collection**: Emphasis on virtual synthetic data to capture diverse quality variations
- **Feature Engineering**: Extract features that explain liveness behaviour, with a focus on mapping users experience to ground truth data
- **Machine Learning**: Adaptable models that understand the quality-liveness relationship, suitable for various platforms from Raspberry Pi to high-end servers
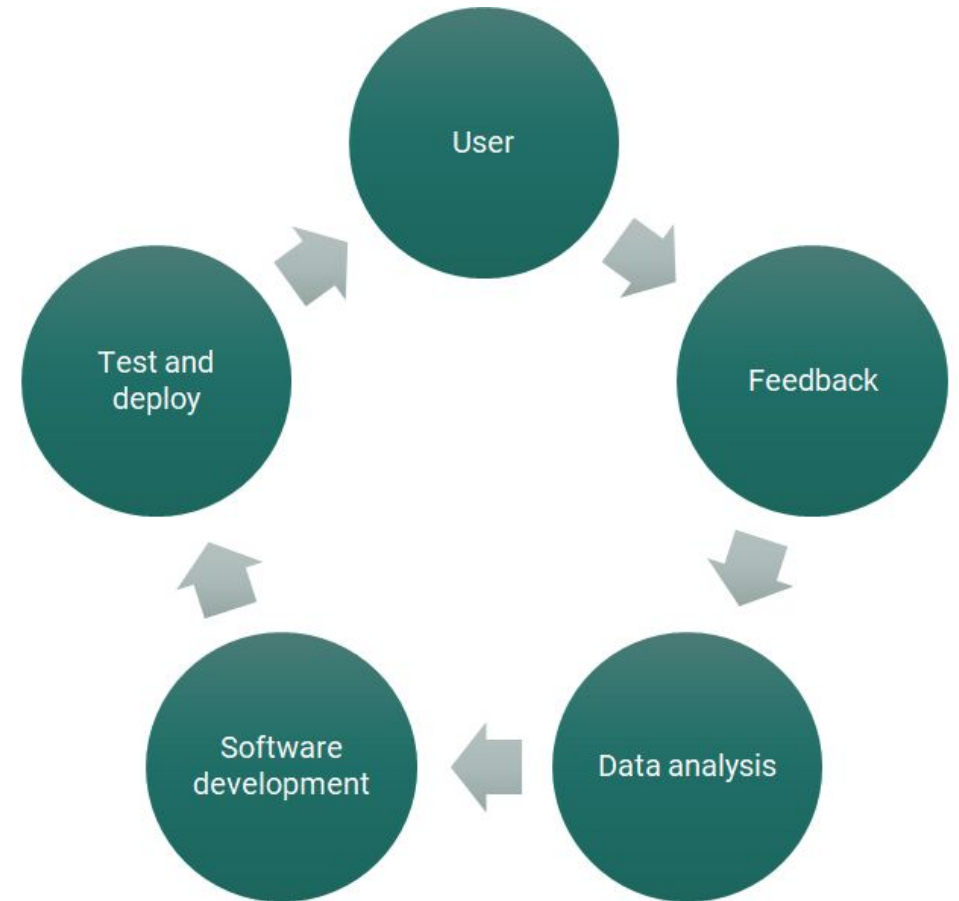
Results

Quality and Livenes correlation
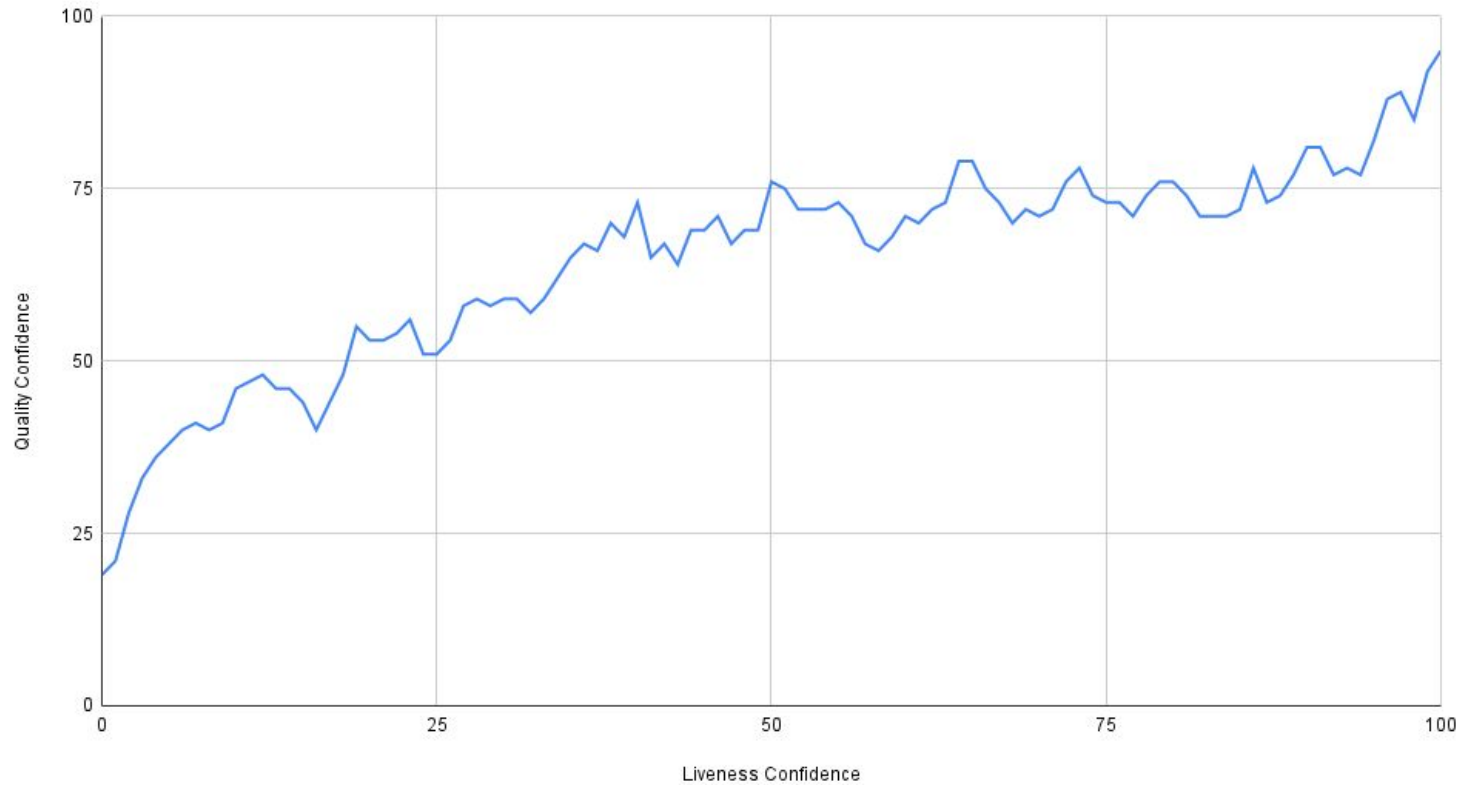
- **Correlation Analysis**. Understanding the relationship between image quality, liveness confidence and image type

Feature Engineering

- **Functionality Based on User Review**: Incorporating feedback from real-world users to refine and improve metrics.
- **Training Insights**. Leveraging domain knowledge to recognize patterns that correlate with liveness outcomes

Results

- **Examples**: Challenging cases like reflectivity patterns from glasses indicating potential spoof attempts

Machine Learning

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- **ML's Role**: Predicting liveness behaviour based on quality metrics, with emphasis on training challenges and edge cases
- **Training & Testing Models** that can explain liveness failures/successes
- **Avoiding Overfitting**: Generalizing across diverse quality scenarios
- **Practical Strategies**: Milestones or checkpoints instead of isolated experiments
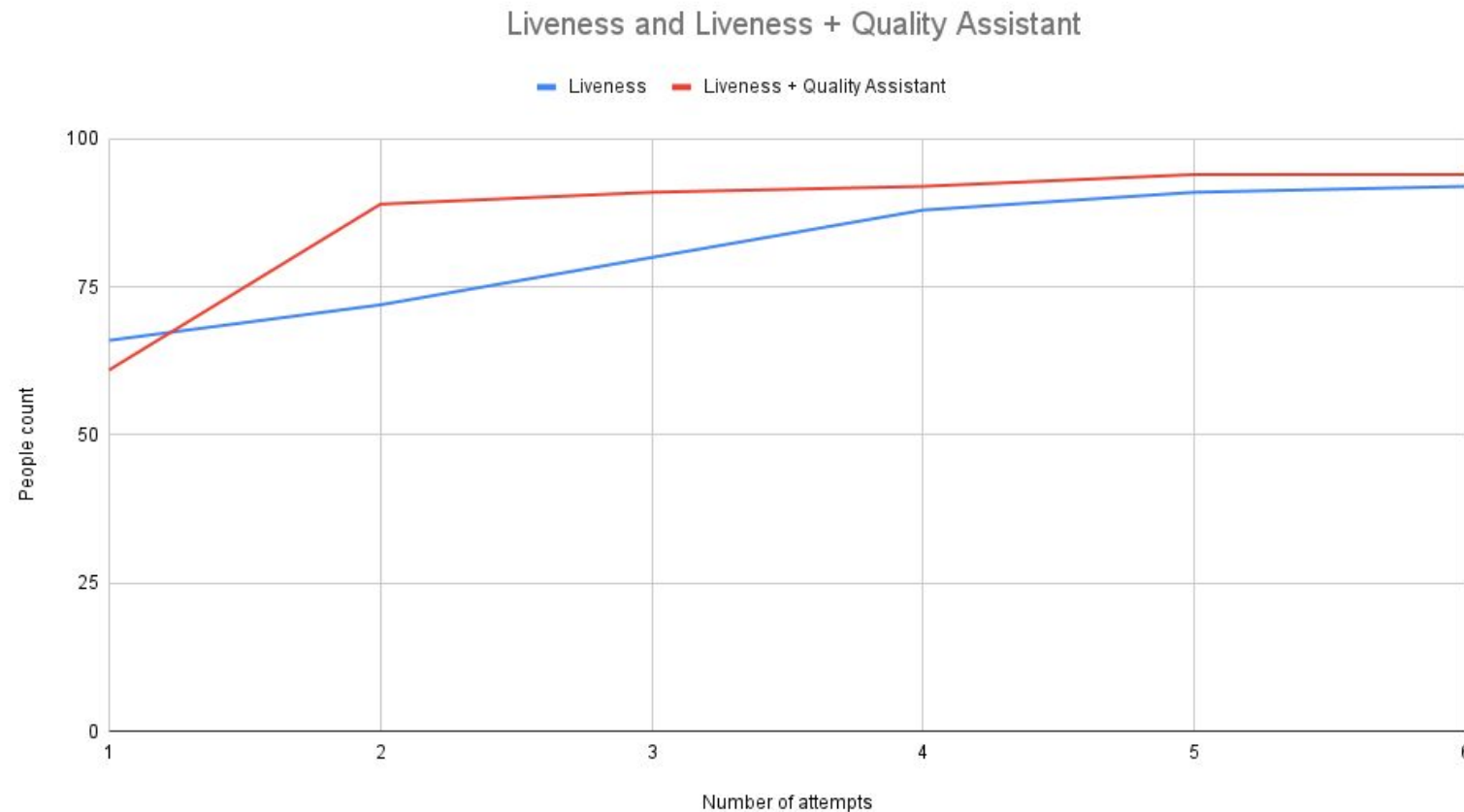
Results

Underexposure, Overexposure, Compression and Blur correlation with Liveness

Legend: Underexposure, Overexposure, Compression, Blur
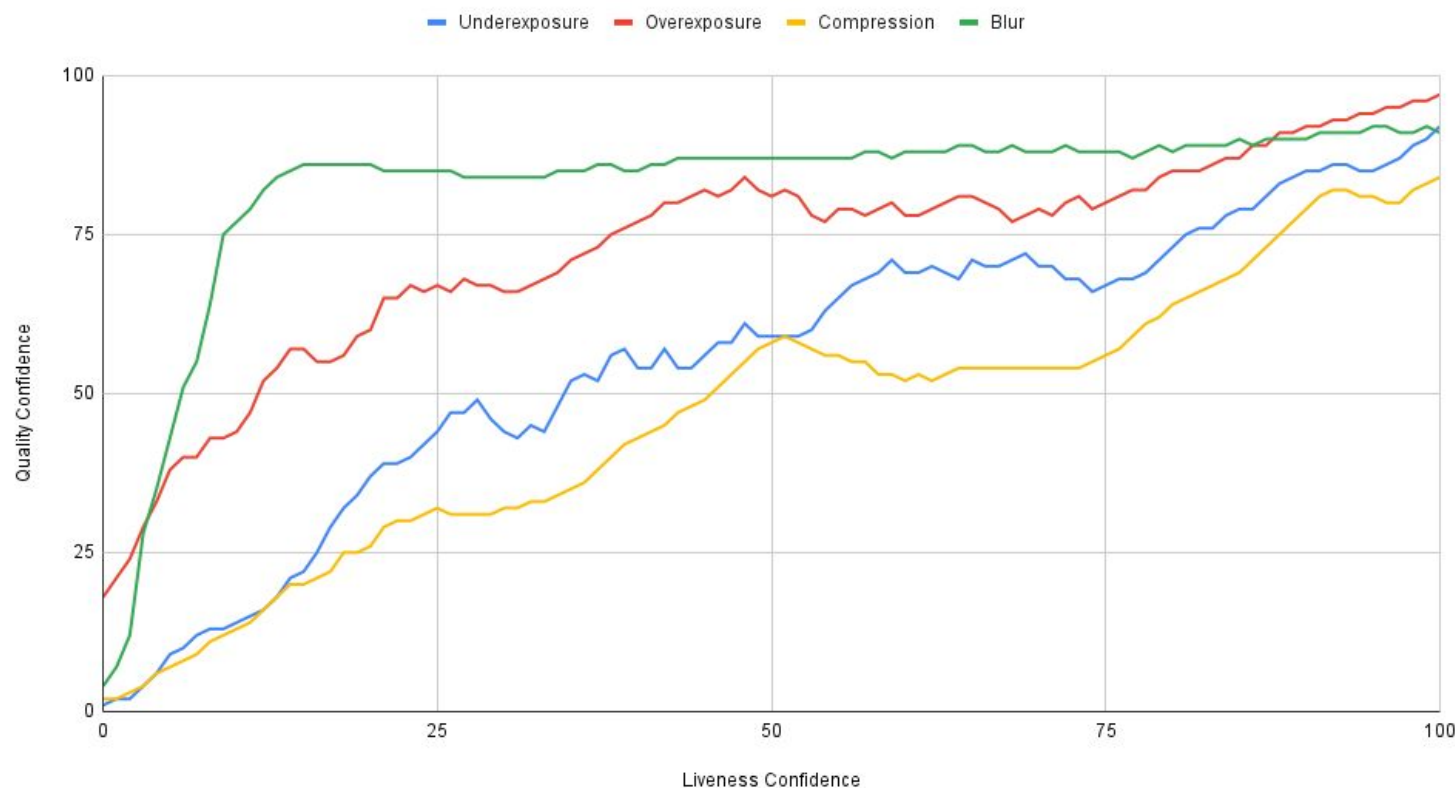
- **Metrics:** Understanding the correlation between quality factors and liveness detection outcomes

Results

Liveness and Liveness + Quality Assistant

Legend: — Liveness — Liveness + Quality Assistant

Y-axis: People count (0, 25, 50, 75, 100)
X-axis: Number of attempts (1, 2, 3, 4, 5, 6)

- **Traditional vs Optimized:** A comparative analysis of how quality metrics explain liveness behaviour.

Benefits of Mutual Optimization

- **Enhanced Understanding:** Diagnose liveness algorithm behaviour
- **User Experience:** Predict and improve authentication outcomes
- **Implications:** Offering a predictable and explainable liveness detection as more polished, comprehensive product.

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Conclusion And Future

- **Optimized Quality Metrics:** Key to explaining and predicting liveness detection
- **Beyond Technology:** Building systems that are transparent and understandable
- **Holistic View of Liveness:** Recognizing Liveness as an integrated system, not just an algorithm