THE SKI BLACK BOX

Why Skiing Needs an Offline Performance Recorder

Whitepaper v1.1

December 2025

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Abstract

This paper proposes the Ski Black Box—a new standard for capturing skiing performance data locally on consumer devices. Unlike existing solutions that rely on cloud infrastructure, GPS-only tracking, or social features, the Ski Black Box captures both movement dynamics and GPS data while ensuring complete data ownership through local storage and open export formats.

1. The Problem: Skiing's Data Gap

1.1 High-Speed Sport, Zero Record

Recreational skiing routinely involves speeds of 40-60 km/h on constantly changing terrain. Despite this, the sport lacks any standardized method for recording objective performance data. Compare this to aviation (Flight Data Recorders), automotive (Event Data Recorders), motorsport (telemetry systems), and cycling (power meters and standardized data formats).

Skiing has none of this. Performance assessment relies almost entirely on subjective observation or video analysis—methods that cannot scale.

1.2 The Cloud Dependency Problem

Most ski tracking applications require internet connectivity—exactly where connectivity is least reliable. Mountain environments present unique challenges: no cell coverage in remote areas, crowded networks at popular resorts, and weather interference.

2. The Solution: Ski Black Box Standard

2.1 Definition

A Ski Black Box is defined as a local, offline performance recorder that captures both movement dynamics and GPS data, stores everything on-device, and exports to open formats—without requiring network connectivity, user accounts, or cloud storage.

2.2 Core Principles

1. **Offline by Design** — All processing occurs on-device.
2. **No Identity Required** — No accounts, no email, no sign-up.
3. **No Cloud Storage** — All data remains on the user's device.
4. **Your Data Stays Local** — GPS tracks and scores stored exclusively on device.
5. **Export Anytime** — Open formats (CSV, GPX, JSON). No vendor lock-in.
6. **Built for Performance & Safety** — Skill improvement and safety, not social sharing.

2.3 Data Captured

- **Turn Rhythm:** Turns per minute, converted to BPM
- **Edge Transitions:** Lateral G-forces and timing
- **GPS Track:** Complete route with coordinates and altitude
- **Session Score:** Overall technique score (0-100)
- **Impact Events:** Fall detection (3G+ threshold)

3. Stakeholder Benefits

- **Individual Skiers:** Objective feedback without video
- **Ski Instructors:** Quantitative data to supplement observation
- **Ski Schools:** Standardized assessment criteria
- **Resorts:** Safety analytics, incident reconstruction
- **Equipment Brands:** R&D feedback on equipment performance

4. Reference Implementation

A working reference implementation exists: **SkiCoach.app** is a privacy-first, 100% offline ski coaching application built in Austria, available on iOS and Android.

- **Sensors:** GPS, accelerometer, gyroscope, barometer
- **Processing:** On-device AI models
- **Storage:** Local SQLite (encrypted)
- **Export:** CSV, GPX, JSON formats
- **Data collection:** Zero. No analytics, no tracking.

5. Conclusion

The Ski Black Box represents a new layer in skiing's technology stack—one that prioritizes performance over social features, privacy over data collection, and reliability over cloud dependency.

The first implementation exists. The standard is defined. The question is who will adopt it next.

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