



A LiDAR-Based iOS Application for Personalized Alpine Footwear Recommendation

(In partnership with SCARPA North America)

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Project Overview

The SCARPA Boot Fitter is an iOS application designed to scan a user's foot using LiDAR technology, extract foot measurements, and recommend the optimal SCARPA ski boot from a curated catalog of 29 models. Developed as the capstone practicum project for ATLAS 6910 (Social Impact Practicum) at the University of Colorado, Boulder's ATLAS Institute, running from January 15, 2026, to April 27, 2026. The app was built in Swift using Xcode and Apple's ARKit framework, with testing integration of the 3D Measure Up scanning API for improved point cloud accuracy and downstream measurement extraction.

The application follows a four-phase scanning pipeline (modeled after 3D Measure Up): (1) a Setup Phase in which the user positions the foot and device, (2) a Scanning Phase in which the app captures a rotating point cloud of the foot and lower leg, (3) a Reconstruction Phase in which the raw mesh is processed into a 3D model, and (4) a Measurement Phase in which the model yields precise foot dimensions in mondo sizing. These measurements then drive a recommendation engine that filters SCARPA's catalog against foot length, width, and use-case preferences to surface the most compatible boot.

The project was conducted in collaboration with Olivia McCartney, Digital, Communications, and Engagement Coordinator at SCARPA North America, and with technical input from Massimo Pellizzer, SCARPA's Ski Boot Category Manager at the company's headquarters in Italy. While not used in the final project, 3D Measure Up's API was used for testing and represented by Pankaj Choudhari (Product Owner) and Shivdeep Sid Namedeo (Senior Manager, Business Development).

Why this Project

The decision to pursue this practicum with SCARPA emerged from a deeply personal convergence of values, background, and technical ambition. Growing up in Traverse City, Michigan with Lake Michigan as my backyard and the Rockies as my adopted home, I have spent my entire life embedded in outdoor sports culture. I am an active telemark skier, an alpine ski racing coach, a volunteer ski patroller at Eldora Mountain, and an adaptive rowing coach. My goal is not incidental to my identity—it is the physical interface through which I engage with the mountains. Ski boots, in particular, occupy a uniquely consequential role: no piece of equipment affects performance, safety, and comfort as directly as fit.

When reviewing practicum partners, I sought organizations that valued the outdoor spaces I hope to protect. After reaching out to several, Olivia McCartney was enthusiastic about technology at the intersection of footwear innovation and sustainability, with alignment to the United Nations Sustainable Development Goals, specifically Goal #12: Responsible Production and Consumption. That framing resonated with my graduate program's social impact track and with a recurring theme in my prior work—that good technology should reduce waste, extend access, and create more equitable outcomes. Boot returns from poor fit generate measurable carbon and logistical costs; a recommendation engine that reduces that friction has both an environmental and economic rationale.

Beyond sustainability, the project represented a genuine technical frontier. LiDAR-based foot scanning for consumer iOS devices is emerging, and translation of iPhone LiDAR capability into accurate, repeatable foot measurements is a consequential open-ended engineering problem—exactly the kind of challenge I wanted to take on at the end of my graduate training.

The Need

SCARPA does not currently have a digital recommendation system for their footwear. As I learned during my onboarding meeting with Olivia McCartney, Kayla Hicks, and John Weir, on January 22, 2026, the company's existing process relies entirely on in-person interaction with product representatives, trained retail staff, and third-party review (O. McCartney, personal communication, January 22, 2026). There is no tool a customer can use independently to arrive at a confident boot recommendation before walking into a shop or placing an online order. This gap is consequential for three interconnected reasons.

First, ski boot fitting is unusually complex. Unlike general athletic footwear, ski boots are rigid, highly specialized instruments that must accommodate wide variation in foot geometry, skiing style, and intended terrain. The fit variables that matter—foot length, foot width, heel-to-ball length, instep height, calf circumference—cannot be adequately addressed by shoe size alone. Without accessible guidance, customers routinely purchase ill-fitting boots, experiencing unsafe skiing with pain and reduced performance, and ultimately returning products.

Second, this problem intensifies as direct-to-consumer online sales grow. When a customer buys from a physical retailer, a trained boot fitter is present. When that customer buys directly from SCARPA's website or through a generalist outdoor retailer, no such expertise is available—resulting in high returns, worse customer experience, and additional environmental cost from shipping and reprocessing. This gap is not hypothetical. My hometown of Traverse City, Michigan has a thriving community of touring and telemark skiers, yet none of our local ski shops carry SCARPA. A customer there who wants a new tele setup has no choice but to order online, without access to a fit expert, often without even having held the boot in their hands.

Third, SCARPA has no visibility into what their customer's feet look like. Data collected through a scanning application could inform more size-inclusive product development—a capability SCARPA currently lacks entirely. The SCARPA Boot Fitter was conceived as a direct response to this gap: a tool that extends expert fit guidance to any customer with an iPhone (12 or newer), regardless of access to a specialty retailer.

Contributions

The project was executed entirely by me as a solo developer and researcher over fourteen weeks, spanning the full product development lifecycle from initial concept through implementation, testing, and documentation.

On the research side, I conducted informal stakeholder interviews with the SCARPA North America marketing team, reviewed SCARPA's existing product catalog and technical specifications from 29 ski boot models across Alpine Resort, Alpine Touring, and Telemark categories, and engaged directly with SCARPA's Italy-based product team to understand boot geometry, last design philosophy, and size-to-fit relationships. I conducted a landscape analysis of existing foot scanning technologies including ScanSoles, INFOOT optical 3D scanners, and the 3D Measure Up platform, to identify the most viable technical approach for a solo, time-bounded academic project.

On the technical side, I designed and built the full iOS application in Swift, including the LiDAR scanning pipeline, ARKit integration, 3D Measure Up API integration, boot catalog data structures, recommendation logic, and user interface. I implemented a 3D bounding box to constrain LiDAR capture to the foot and the lower leg, reducing interferences and noise from the floor and surrounding environment, and built out a complete catalog of SCARPA ski boots including product descriptions, technical specifications, and a women's/men's toggle. I also

implemented a PLY point cloud export feature enabling future collaboration with SCARPA's product team for size-inclusive boot design. Throughout the build, I used Claude Code to assist with debugging and tackling features outside my prior experience.

On the production side, I created a video documenting my project, produced a custom alginate-and-plaster cast of my own foot (which failed), and ultimately sourced a foot model through my Mom's efforts in Michigan—an essential physical artifact for repeatable testing.

Challenges

The SCARPA Boot Fitter was defined by its obstacles as by its inputs. Three categories of challenges were particularly formative: technical difficulty, external dependencies, and an irreversible data loss event.

The most persistent technical challenge was LiDAR accuracy. Apple's ARKit mesh capture did not behave predictably when applied to foot scanning: the AR mesh consistently included the floor as part of the capture volume, generating noisy point clouds that could not be cleanly separated into foot geometry. I tried different approaches: adding a progress indicator to ensure adequate frame capture, prompting users to tap key biometric anchor points on the foot, and carving out a constrained region in the AR mesh to isolate the foot. None of these approaches yielded consistently accurate measurements during the project's early weeks.

A breakthrough came in Week 6 when, prompted by a candid check-in with my advisor, Denise Powell, I reached out directly to 3D Measure Up, a company that had already solved many of the fundamental problems I was struggling with. Their API integration significantly improved point cloud density and accuracy—but I subsequently discovered I had not been calling the API correctly for several weeks. Diagnosing that misconfiguration was costly, but

ultimately revealed that I had been building my own working model independently. When I lost API access on March 24th, I had not taken a step back as my app generated accurate sizes.

External dependencies proved equally challenging. Sourcing a physical foot model for testing was unexpectedly difficult: SCARPA had none available, the CU Theatre and Dance department lead went cold, and my alginate-and-plaster lifecast of my own foot failed in Week 11. That same week, my Mom had sourced a Chaco foot model after calling 10 local stores in Traverse City—then flew from Michigan to Denver to deliver it. Its late arrival compressed my testing timeline significantly.

The most acute single event of the project was an irreversible code loss on March 25, 2026. While committing my code to GitHub, I accidentally executed a terminal command that overwrote my repository with only my initial January commit—erasing approximately two months of work. The experience was genuinely devastating. I called my parents, and my Dad’s response—“Well, Sis, let’s do it again”—became the operational philosophy for the weekend that followed. I rebuilt the core application over forty-eight hours, producing a cleaner and more architecturally consistent codebase than the one I had lost. I name this phenomenon: Elizabeth’s Law of Reconstructive Mastery, which holds that rebuilding destroyed work from memory produces a better architect because the second time, you already know where you are going.

Organizational Limitations of SCARPA

Working with SCARPA North America was, overall, a positive and professionally enriching experience. The team was responsive, generous with their time, and genuinely engaged with the project. That said, several organizational characteristics shaped and occasionally constrained the project’s development.

First, SCARPA’s product data is not structured for developer use. The technical specifications I received were shared as marketing documents and PDF tech sheets—formatted for retail staff and customers, not engineers. Translating that data into structured Swift data types required significant manual effort and interpretation, and I was never fully certain that my representations were accurate without direct validation from the product team. The engagement with Massimo Pellizzer and SCARPA’s Italy team was promising in this regard—they expressed willingness to share boot last geometry and internal volume specifications (M. Pellizzer, personal communication, March 16, 2026)—but the timeline did not permit full data transfer before the project’s end.

Second, SCARPA’s organizational structure created communication latency. My primary contacts in Boulder held the relationship, but the product and engineering expertise resided in Asolo, Italy. Coordinating across time zones and within the constraints of a single semester added friction to every technical inquiry. The call with Massimo in Week 9 was enormously valuable, but it came late in the project calendar.

Third, SCARPA has no internal infrastructure for digital product recommendation or customer data collection—no existing API, no foot measurement database, and no workflow for ingesting third-party scanning data. This meant that I was not only building a new product but also sketching the outline of a new organizational capability, with no internal technical champions to advocate for it beyond its marketing team.

Recommendations for the Future

The SCARPA Boot Fitter finishes as a functional prototype with demonstrable scanning capability, a complete boot catalog, and a working recommendation interface—not a production-ready application. That distinction shapes the recommendations below.

The most important near-term priority is measurement accuracy. The application's core value proposition depends entirely on the reliable foot measurements. At the close of this project, the app generates mondo size estimates in the correct range but with inconsistency that would make real-world recommendation unreliable. Resolving this will require deeper engagement with the 3D Measure Up API—specifically, confirming that scan uploads are correctly registered and that returned JSON measurements are parsed and interpreted correctly—combined with a sustained testing protocol using the Chaco foot model.

The second priority is formal data partnership with SCARPA's product team. The PLY point cloud export I added in Week 11 opens a meaningful possibility: that real-world foot scan data collected through the app could inform more size-inclusive boot designs—a data source SCARPA currently does not have. A formal data sharing agreement, combined with technical data transfer promised by Massimo Pellizzer, could make this application far more valuable to SCARPA than a simple recommendation tool—it could become an instrument of product design.

Third, the project would benefit substantially from user testing with actual skiers. Development was almost entirely solo, with limited structured feedback from potential end users. A structured usability study with participants (including both expert skiers and recreational buyers) would generate actionable insights about the onboarding experience, the scanning flow, and the recommendation interface.

Finally, if SCARPA is genuinely interested in deploying this capability, the logical next step is an industry partnership with 3D Measure Up who have already solved much of the core scanning infrastructure problem, combined with investment in a software development resource who can take the prototype to production quality. Alternatively, the project could form the basis of continued graduate or doctoral research into LiDAR-based anthropometric measurement and

its applications to adaptive sports equipment design—a direction I find personally compelling given my coaching background.

Program Reflection: What Prepared Me and What I Needed

The ATLAS Social Impact track prepared me for this project in ways that were both direct and cumulative. ATLAS 5230 (Case Studies in Social Impact) gave me the foundational lens for evaluating technology as a social tool shaped by the values of its makers and the constraints of its context. That framing informed how I approached the sustainability rationale with Olivia McCartney and how I understood SCARPA's organizational limitations—the absence of digital infrastructure, the two continent communication gap, the lack of internal champions—as structural design constraints rather than mere inconveniences.

ATLAS 5250 (Fieldwork Methods) gave me the scaffolding for structured stakeholder engagement. In practice, the SCARPA Boot Fitter began from personal conviction—I knew the problem existed because I had lived it as a skier and coach—but fieldwork methods gave me the vocabulary to articulate it rigorously and the discipline to ground my design decisions in evidence. That instinct was sharpened further in ATLAS 5240 (Technology for Social Impact Laboratory), where our team partnered with AdventHealth to address nurse retention challenges. Forty-one surveys, four interviews, and three stakeholder workshops produced a statistically grounded intervention, and that experience directly shaped how I approached onboarding conversations with SCARPA.

Hands-on prototyping fluency came from courses across the broader ATLAS curriculum. ATLAS 3710 (Material Studies and Practices) and ATLAS 4330 (Wearable Technology) trained me to work with physical materials under constraints and treat early failures as productive. ATLAS 4519 (How to Hack Almost Everything) was my first direct exposure to ARKit, through

the kART project—an FPV remote vehicle controlled through AR goggles—which meant I was not encountering Apple’s spatial computing framework for the first time when I arrived at the SCARPA Boot Fitter.

What the program did not prepare me for: there is no Swift, Xcode, or ARKit coursework in the ATLAS curriculum, and everything I built on the iOS development side was self-taught. A workshop on mobile spatial computing would meaningfully lower the barrier for future students pursuing software-adjacent capstone projects. More significantly, the program offers almost no preparation for the legal and organizational dimensions of industry partnerships—IP agreements, data sharing frameworks, and the dynamics of working across a two-continent corporate structure. Those gaps became visible only once I was inside the project, and navigating them required improvisation that formal preparation could have made more principled.

Conclusion

The SCARPA Boot Fitter project was among the most technically demanding and personally meaningful things I have built in graduate school. It required me to extend beyond what I knew—iPhone app development using Xcode and ARKit, an unfamiliar third-party API, a two-continent industry partnership, recovering from a catastrophic data loss event, and physical artifact creation by casting my own foot in dental alginate.

What I built is a prototype, not a product—but a prototype of something real and needed. A tool that could reduce the friction of ski boot selection, extend expert guidance to customers who lack access to a specialty retailer, and generate foot geometry data that could inform more inclusive boot design. The path forward is clear, even if I will not be the one to walk all of it.

I came into this program with a decade of experience coaching adaptive and able-bodied athletes, advocating for more sustainable practices, and building technology to advance

communities. The SCARPA Boot Fitter project sits at the intersection of all these threads: technology as a tool for reducing inequity in access to physical activity, applied in an industry that I love, in service of a company that shares the values I care about. That alignment was not accidental—it was the product of three semesters of graduate training that taught me, above all, to be intentional about where I put my energy.

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