Follow the Pioneers: Towards Personalized Crowd-sourced Route Generation for Mountaineers

Florian Daiber
DFKI, Computer Science
Campus Saarland
Saarbrücken, Germany
florian.daiber@dfki.de

Frederik Wiehr
DFKI, Computer Science
Campus Saarland
Saarbrücken, Germany
frederik.wiehr@dfki.de

Felix Kosmalla
DFKI, Computer Science
Campus Saarland
Saarbrücken, Germany
felix.kosmalla@dfki.de

Antonio Krüger
DFKI, Computer Science
Campus Saarland
Saarbrücken, Germany
krueger@dfki.de

UbiComp/ISWC'17 Adjunct, September 11-15, 2017, Maui, HI, USA

ACM ISBN 978-1-4503-5190-4/17/09.
https://doi.org/10.1145/3123024.3124447

Abstract
Wearable sports technology such as fitness trackers or smart watches has become ubiquitous in our everyday lives, resulting in a vast collection of recorded routes. This technology now enables new forms of tracking and sharing outdoor adventures, that go beyond prosaic descriptions and photographs of the tour. Existing web mapping services and online tour diaries already allow mountaineers an improved preparation of tours but it remains still a time-consuming and cumbersome task. In this paper we introduce the concept of *pioneers in outdoor activities*. The proposed concept lets people define their pioneers, which are other ambitious athletes who are well known and trusted experts of the area. Using the segments of their tracks and other personal preferences (e.g. length, elevation and difficulty) a personalized route that is based on the pioneers' activities is generated and recommended to the user.

Author Keywords
Alpine sports; outdoor activities; sports technologies; activity tracking; navigation.

ACM Classification Keywords
H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous

Motivation

Today, wearable fitness trackers, running watches and bike computers, and other tracking tools are ubiquitous [15, 4]. Many of these trackers incorporate corresponding smartphone apps that visualize the recorded data, reward the user with achievements, act like a mobile coach, or enable sharing with social networks. Mountaineers are also adapting to these new technologies that could support people in many mountain scenarios such as activity tracking and life logging, navigation, or emergency support.

Current tracking technology now enable new forms of story telling of outdoor adventures, that go beyond prosaic descriptions and photographs of the tour. Web mapping services like Strava (http://www.strava.com), Komoot (http://www.komoot.com) or Alltrails (http://www.alltrails.com) and other forms of online tour diaries already allow mountaineers an improved preparation of tours. Thus, mountaineers are not restricted to classic guide books anymore but can rely on a variety of online resources to carefully prepare their mountain adventures. Besides reading tour descriptions of individual people, they can use digital maps to plan their outdoor activities for later navigation in the outdoor environment. However, it remains open how technologies and applications for mountaineers can learn from ubiquitous computing research in order to provide more joyful, motivating, and safer outdoor experiences.

In this position paper, we propose the concept of a system that lets people define their pioneers, which are other ambitious athletes who are experts in a certain area. Using the segments of their tracks and other personal parameters (e.g. desired length, elevation and modality) a personalized route that is based on the pioneers' activities is generated and recommended to the user.

Related Work

In Mobile HCI and UbiComp, sports tracking technology has been explored in the context of sports. The motivations for users to track activities are diverse. According to Rooksby et al. [12] the reasons for activity tracking could be directive, documentary or diagnostic, but also motivated by collectable rewards or simply for the sake of the fetishized gadget. Ojala and Saarela [9] have shown that sharing also plays an important role for the motivation of the users. By interviews they identified seven main categories that motivated them to use the online communities. Outdoor sports tracking [1], for example, has been suggested for climbing [5, 7, 8] and backcountry skiing [3].

New technology can be used to promote special places by providing users with carefully authored locative media experiences [2], to force users to explore their surrounding by challenging them to visit new, unfamiliar places [6] or to facilitate solitude by providing guidance on how to avoid other people [10]. There has been some more related research in the field of navigation in general (e.g. [13]), but in particular in research on pedestrian navigation that incorporates social aspects such as recommendations and local knowledge (e.g. [11, 14, 16]).

To our knowledge no solution for route recommendation for mountain activities exists so far that is based on experts' local knowledge and tailored to the user's experiences and expectations. While for the tracking of outdoor experiences several solutions exist, the exploration of unknown terrain is still requires a cumbersome and time consuming preparation process. This work aims to make use of tracking data in order to generate personalized route recommendations for mountaineers.

Concept

Millions of GPS-tracked activities are uploaded to sports and activity tracking services such as Strava, Komoot, and Alltrails every day from around the globe. The majority of these services provides social features that already allow users to follow their friends but also other athletes including professionals. However, until now, the GPS-tracks of those services can be either used as is by following the exact same track, or they have to be manually edited. This manual editing of an existing track is often cumbersome and time consuming. Furthermore, it is tricky yet impossible to combine different tracks into one.

To some extend, these services already support the route planning process by providing routing suggestions based on their user data. Strava's route planning component, for example, suggests the most popular connection between two manually defined points based on a heat map. Komoot gives recommendations based on user-defined "highlights" (i.e. points of interest or route segments). However, this data is mostly anonymous, since it is aggregated over all athletes in the respective area and thus, the user cannot estimate the trustworthiness of the chosen segments. Albeit a segment may be frequently used, that does not necessarily mean that it is enjoyable or safe but it may merely be the result of more and more people using this segment because it was recommended by the system.

We envision a slightly different approach to route planning that fundamentally extends existing route planning services. The main assumption is that people define their personal pioneers, which are athletes they follow and trust as knowledgeable experts for a specific area. An example for such pioneers may be the group of older gentleman riding their road bikes for many years and thus knowing hidden paths with smooth surface far away from busy roads used by cars

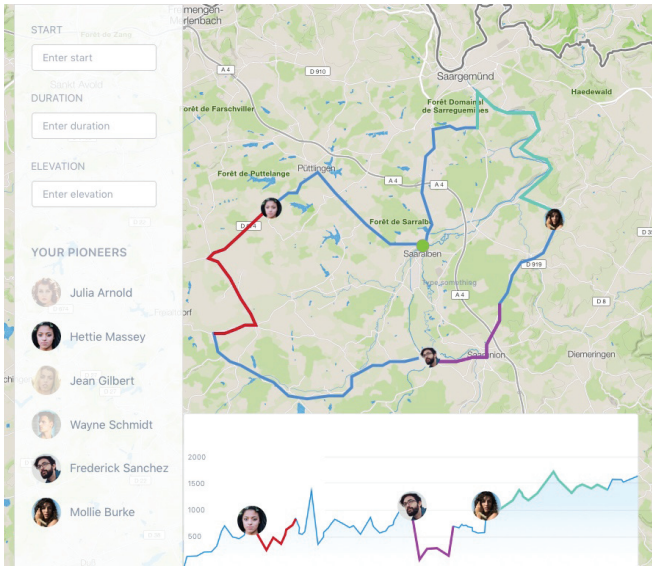

Figure 1: Mockup of the Pioneers interface

and trucks. Another example might be a successful trail runner who lives in a mountain region and could serve as a pioneer for athletes spending their vacation in this area as tourists. Using popular segments of the pioneers' tracks and personal preferences (e.g. desired length, elevation and modality) a personalized route that is based on the pioneer's activities is generated and recommended to the user.

We envision the workflow as follows: the user opens up the tool and selects the desired length, elevation, modality, and starting point of the route. She then chooses one or more of her pioneers. The choice can make a difference for the resulting route recommendation since some of her pioneers might be into excessive up-hill cycling while others

may prefer segments that are less hilly. A mockup of the interface can be seen in Figure 1.

The above approach represents a basic version of personalized crowd-sourced route generation, i.e. it supports an easy route planning mechanism that relies on popular segments of pioneers. However, planning a difficult route in remote mountainous areas requires lot more than just nice recommendations. A crucial aspect of planing a route is to somehow assess the overall risk including personal experience and fitness, difficulty, natural hazards, and seasonal conditions. These factors have to be considered for recommendations based on pioneers routes. It could make a big difference if a tour has been done early or in the end of the season.

Conclusion

In this position paper, we proposed the concept of pioneers in outdoor activities. We believe that this approach is able to support mountaineers in doing more informed preparation of routes. The proposed approach is very well suited for route planning in mountain activities (e.g. hiking, climbing, mountain biking) but might also inform other sports that highly rely on athletes' experiences such as sea trekking, kayaking or sailing.

However, the whole concept has yet to be built and evaluated. Thus, in future work, we will build a prototypical route planning app and evaluate it by comparing the quality of these personalized routes to traditionally planned routes.

References

[1] Aino Ahtinen, Minna Isomursu, Ykä Huhtala, Jussi Kaasinen, Jukka Salminen, and Jonna Häkkilä. 2008. Tracking Outdoor Sports — User Experience Perspective. In *Proceedings of the European Conference on Ambient Intelligence (AmI '08)*. Springer-Verlag, Berlin, Heidelberg, 192–209. DOI: http://dx.doi.org/10.1007/978-3-540-89617-3_13

[2] Keith Cheverst, Trien V. Do, and Dan Fitton. 2015. Supporting the Mobile In-situ Authoring of Locative Media in Rural Places: Design and Expert Evaluation of the SMAT App. *Int. J. Handheld Comput. Res.* 6, 1 (Jan. 2015), 1–19. DOI: http://dx.doi.org/10.4018/IJHCR.2015010101

[3] Anton Fedosov and Marc Langheinrich. 2015. From Start to Finish: Understanding Group Sharing Behavior in a Backcountry Skiing Community. In *Proceedings of the 17th International Conference on Human-Computer Interaction with Mobile Devices and Services Adjunct (MobileHCI '15)*. ACM, New York, NY, USA, 758–765. DOI: http://dx.doi.org/10.1145/2786567.2793698

[4] Daniel Harrison, Paul Marshall, Nadia Bianchi-Berthouze, and Jon Bird. 2015. Activity Tracking: Barriers, Workarounds and Customisation. In *Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing (UbiComp '15)*. ACM, New York, NY, USA, 617–621. DOI: http://dx.doi.org/10.1145/2750858.2805832

[5] Raine Kajastila, Leo Holsti, and Perttu Hämäläinen. 2016. The Augmented Climbing Wall: High-Exertion Proximity Interaction on a Wall-Sized Interactive Surface. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (CHI '16)*. ACM, New York, NY, USA, 758–769. DOI: http://dx.doi.org/10.1145/2858036.2858450

[6] Ben Kirman, Conor Linehan, and Shaun Lawson. 2012. Get Lost: Facilitating Serendipitous Exploration in Location-sharing Services. In *CHI '12 Extended Abstracts on Human Factors in Computing Systems (CHI EA '12)*. ACM, New York, NY, USA, 2303–2308. DOI: http://dx.doi.org/10.1145/2212776.2223793

[7] Felix Kosmalla, Frederik Wiehr, Florian Daiber, Antonio Krüger, and Markus Löchtefeld. 2016. ClimbAware: Investigating Perception and Acceptance of Wearables in Rock Climbing. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (CHI '16)*. ACM, New York, NY, USA, 1097–1108. DOI: http://dx.doi.org/10.1145/2858036.2858562

[8] Cassim Ladha, Nils Y. Hammerla, Patrick Olivier, and Thomas Plötz. 2013. ClimbAX: Skill Assessment for Climbing Enthusiasts. In *Proceedings of the 2013 ACM International Joint Conference on Pervasive and Ubiquitous Computing (UbiComp '13)*. ACM, 235–244. DOI: http://dx.doi.org/10.1145/2493432.2493492

[9] Jarno Ojala and Johan Saarela. 2010. Understanding Social Needs and Motivations to Share Data in Online Sports Communities. In *Proc. MindTrek*. 95–102. DOI: http://dx.doi.org/10.1145/1930488.1930508

[10] Maaret Posti, Johannes Schöning, and Jonna Häkkilä. 2014. Unexpected Journeys with the HOBBIT: The Design and Evaluation of an Asocial Hiking App. In *Proceedings of the 2014 Conference on Designing Interactive Systems (DIS '14)*. ACM, New York, NY, USA, 637–646. DOI: http://dx.doi.org/10.1145/2598510.2598592

[11] Daniele Quercia, Rossano Schifanella, and Luca Maria Aiello. 2014. The Shortest Path to Happiness: Recommending Beautiful, Quiet, and Happy Routes in the City. In *Proceedings of the 25th ACM Conference on Hypertext and Social Media (HT '14)*. ACM, New York, NY, USA, 116–125. DOI: http://dx.doi.org/10.1145/2631775.2631799

[12] John Rooksby, Mattias Rost, Alistair Morrison, and Matthew Chalmers Chalmers. 2014. Personal Tracking As Lived Informatics. In *Proc. CHI*. 1163–1172. DOI: http://dx.doi.org/10.1145/2556288.2557039

[13] Nina Runge, Pavel Samsonov, Donald Degraen, and Johannes Schöning. 2016. No More Autobahn!: Scenic Route Generation Using Googles Street View. In *Proceedings of the 21st International Conference on Intelligent User Interfaces (IUI '16)*. ACM, New York, NY, USA, 147–151. DOI: http://dx.doi.org/10.1145/2856767.2856804

[14] Johannes Schöning, Brent Hecht, and Nicole Starosielski. 2008. Evaluating Automatically Generated Location-based Stories for Tourists. In *CHI '08 Extended Abstracts on Human Factors in Computing Systems (CHI EA '08)*. ACM, New York, NY, USA, 2937–2942. DOI: http://dx.doi.org/10.1145/1358628.1358787

[15] Jakob Tholander and Stina Nylander. 2015. Snot, Sweat, Pain, Mud, and Snow: Performance and Experience in the Use of Sports Watches. *Proceedings of the ACM CHI'15 Conference on Human Factors in Computing Systems* 1 (2015), 2913–2922. DOI: http://dx.doi.org/10.1145/2702123.2702482

[16] Josh Jia-Ching Ying, Eric Hsueh-Chan Lu, and Vincent S. Tseng. 2012. Followee Recommendation in Asymmetrical Location-based Social Networks. In *Proceedings of the 2012 ACM Conference on Ubiquitous Computing (UbiComp '12)*. ACM, New York, NY, USA, 988–995. DOI: http://dx.doi.org/10.1145/2370216.2370431