Auto Generated Orienteering Maps

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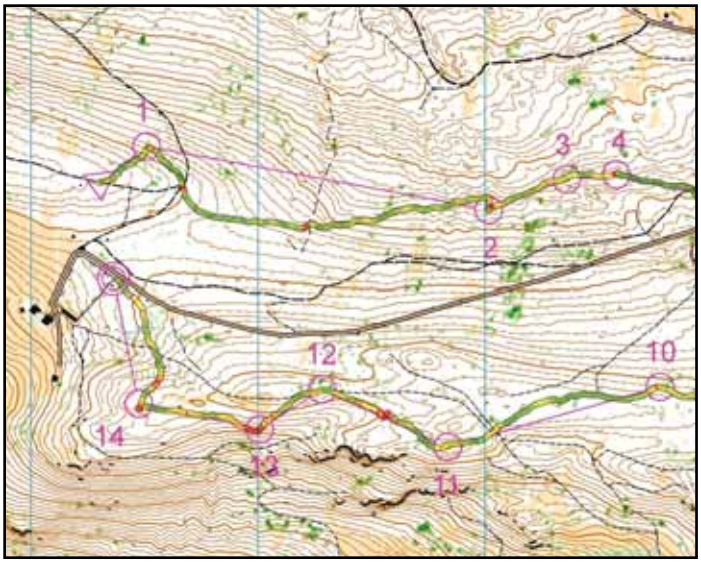
Can we have a very accurate base map to easily start a new map project, and then reduce production time and cost? What do we need to have in this base map? And how can we do Orienteering training in a new unmapped forest? I will now try to answer these questions without going into too much detail; let me begin at the last question.

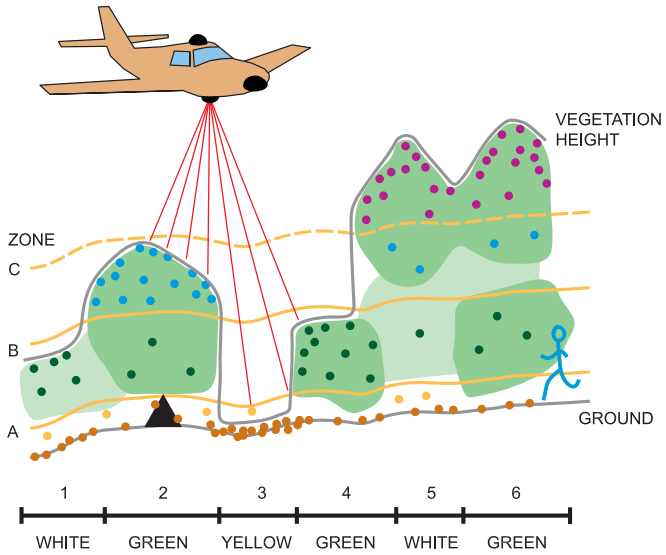
Three years ago in Finland some friends told me about Karttapullautin, a program capable of auto generating O-maps from LiDAR data (download for free at Ref [3]); I was very curious but at that time I was able only to play with Finnish LiDAR data. In August, just before coming to Australia, I discovered that there were new LiDAR data online in my Region (Trentino-Alto Adige, Italy) Land Browser for free. So I selected an unmapped area, and made the program auto generate the map. I set a course on it and I ran this with my girlfriend (elite orienteer); we were both amazed because we really enjoyed that 'next generation' orienteering. The forest was actually really nice and we were really satisfied about the map: I would vote it 4.5/5 for a training purpose (see also this report Ref [2]).



Control 1: cliff – amazing to actually see a small cliff there!

Light Detection And Ranging is a detection system which works on the principle of radar, but uses light from a laser. A LiDAR instrument principally consists of a laser, a scanner, and a specialized GPS receiver. Aeroplanes and helicopters are the most commonly used platforms for acquiring LiDAR data (or more technically: point clouds) over broad areas. The light pulses - combined with other data recorded by the airborne system - generate precise, three-dimensional information about the shape of the terrain and its surface characteristics.

The first returned laser pulse is the most significant return and will be associated with the highest feature in the landscape like a treetop or the top of a building. The first return can also represent the ground, in which case only one return will be detected by the LiDAR system. Multiple returns are capable of detecting the elevations of several objects within the laser footprint of an outgoing laser pulse. The intermediate returns, in general, are used for vegetation structure, and the last return for bare-earth terrain models. The last return will not always be from a ground return. For example, consider a case where a pulse hits a boulder on its way to the ground and the pulse does not actually reach the ground. In this case, the last return is not from the ground but from the boulder that reflected the entire laser pulse.



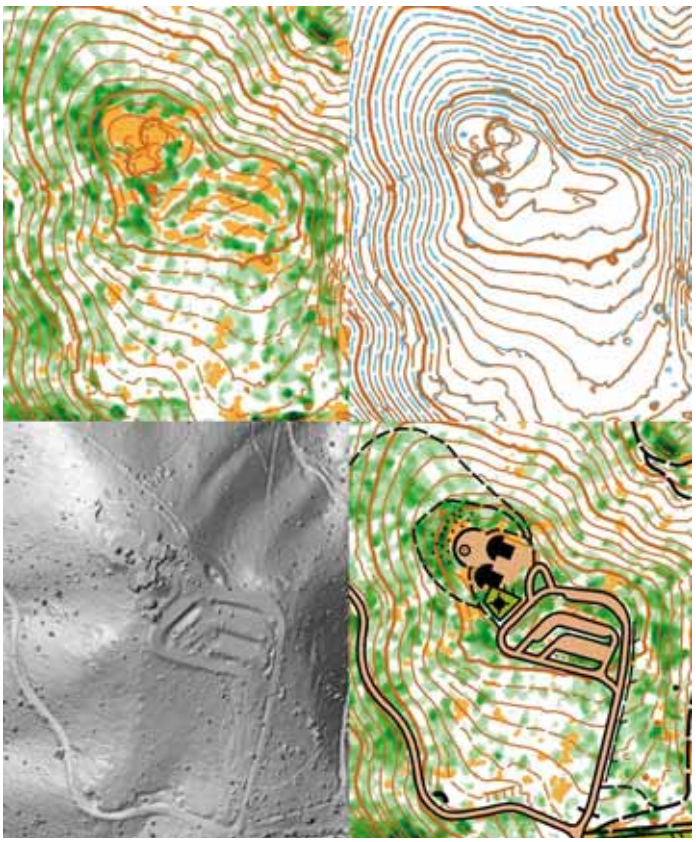
Different returns to be able to identify vegetation.

With suitable LiDAR data we can have O-Training just using Karttapullautin (easy to use: drag and drop LiDAR file) and a course setting program. Karttapullautin (Pullauta for short) creates 5m contour vectors (including algorithms for appropriate use of form lines and purple colour for bottom of depressions to distinguish them from others), vegetation (PNG) and cliffs; water areas and buildings, if available in the LiDAR file (normally *.las or *.laz). Then we just need to add some tracks or major roads and to do this we can use OCAD12 to generate hill shading background (DTM – useful to see ground details, tracks, roads and minor watercourses).

Sometimes it is interesting to compare the contours between Pullauta and OCAD. I have noticed that sometimes OCAD has more detail in some areas regarding contours, however it creates the entire form line whereas Pullauta only draws what is needed i.e. the "useful" information.

Finally, before a real walk on the terrain or simple training, we can also check against the aerial images to add some details or new updates (like forest felling). This is everything a mapper can dream to have as a georeferenced base map, and then you decide to print what you prefer.

I am currently living in South Australia thanks to the Australian Orienteering Coaching Scholarship. In addition I have been given lots of mapping projects. Given my experience in making O-maps from LiDAR, Adrian Uppill saw the possibilities of gaining knowledge and specifically using local data for generating Orienteering maps. When it was discovered that Airborne Research Australia was based in Adelaide they were immediately contacted. ARA, established in 1996, is a self-funding, not for profit, Research Institute within Flinders University. The core activity of ARA is the use of airborne platforms for a wide range of applications and projects, mainly in the Environmental Research & Development area.



Map sample from Mount Lofty.

Adrian and I went to Dakota Dr, Parafield Airport (ARA hangar and office) to discuss the application of LiDAR data for Orienteering map making and whether we would be able to test some data. We were given several samples and in particular one of Mount Lofty summit in the Adelaide Hills where we did significant testing and fieldwork. In the image you can see the Pullauta result (without cliffs) in the upper left corner; contours comparison in the upper right corner (Pullauta in brown – OCAD in blue); DTM hill shading in the lower left corner and the final map on the right.

For an Orienteering map we can easily remove the open land areas, they are really small sometimes, but you can find them on the ground and use them to locate and add other features. We were both surprised by the accuracy of the contours and vegetation, however we still have to experiment with cliff generation parameters and the LiDAR configuration process.

Stay tuned on OSA and OA websites for news!

Note: Orienteering Australia recently established a working group headed by Noel Schoknecht to investigate the use of LiDAR for Orienteering mapping in Australia. Stefano and Adrian will be providing the results of their ongoing activities in SA to this group.

Field walk to check boulders and green areas.

References

[1] Airborne Research Australia, www.airborneresearch.com.au/

[2] Scientific Journal of Orienteering, volume 19, issue 1, page 10 (2014)

[3] Jarkko Ryppo, www.routegadget.net/karttapullautin/