INTERNATIONAL SPACE APPS CHALLENGE 2019 IN TARTU

Alexander Kmoch, PhD

Figure 1: Event logo (by Raivo Aunap, Dept. of Geography)

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Executive Summary

The Department of Geography, the Tartu Observatory and Tartu Science Park jointly organised and hosted a 48h hackathon event as part of the 2019 International Space Apps Challenge. This global event happened on the weekend 18.-20. October 2019 at more than 225 locations, 80 countries, world-wide over the course of the weekend with more than 29.000 participants, and with Tartu as the only Estonian location. We are organising this event in Tartu for the second time, after the debut in 2018.

Space Apps is a two-days international hackathon that occurs in cities around the world, globally coordinated by NASA. It is an annual event that pulls citizens together regardless of their background or skill level to address challenges we face on Earth and in Space. Project teams were formed to work on specific topics that they either developed themselves or were suggested by sponsors, the panel or ourselves. The teams' results were then presented and judged by a panel at the end of the event.

From overall 69 registrations initially, we eventually had 8 teams formed from 50 participants. This year Earth Observation was the main topic. We aimed to encourage the hackathon participants to use ESA and NASA satellite remote sensing and other global data as an ingredient to solve problems that matter.

Figure 2: Teams working during the hackathon in one of the dedicated working spaces. Here they demonstrate styling geospatial data layers in QGIS for publishing as web maps with Geoserver.

Like last year, we wanted to provide a safe platform for motivated students from various backgrounds to work together on real problems in a hackathon event, while at the same time learning the benefits of interdisciplinary work and combined team work with different skills. The second goal was to foster networking between the research institutes and the geospatial industry in Tartu, and expose students to the field of geospatial and Earth Observation (EO) applications.

Overall it can be concluded that this was again a very successful event: the teams developed substantial solutions and got engaged with industry and entrepreneurship; inter-departmental and inter-sectoral networks for the research institutes have been strengthened in particular between the organising institutes and with the Tartu Science Park/ESA Business Incubator and several leading innovative (geospatial) software companies, such as CGI, KappaZeta and Datel.

Organisation and Funding

Event organisation team

Main organisers (2):

Evelyn Uuemaa, PhD (senior researcher GEOG[1]), Alexander Kmoch, PhD (researcher GEOG)

Volunteers (9):

Bruno Montibeller (PhD student GEOG),

Again out gratitude goes to the Geograafiatudengite erialaorganisatsioon in Tartu (European Geography Association - for Students and Young Geographers, website http://www.egea.ee/wordpress/).

Helena Maarja Lainjärv, Margarita Oja, Triin Abrams, Karoliina Kurvits, Sigrid Paavle, Jelizaveta Vabištševitš, Maria Bochkova (MSc students Geography and EGEA Tartu members).

[1] GEOG: Department of Geography, University of Tartu

Financial summary

Table 1: External and internal sponsoring and budget summary (organisers underlined and italic)

Company/Institution	Funding pledged	Actual spending
ESA incubation centre / Tartu Science Park	Up to 6000,00 €	3900,00 € for catering, prizes, guidance to ESA/BIC incubation for successful teams
CGI	500,00 €	75 t-shirts with our logo (507 EUR)
Datel	400,00 €	350,00 € for pizza on Friday evening
Geograafia osakond (UT)	In-kind	Printing materials, posters, flyers, certificates
Stickermule	promotion	150 stickers with our logo, free of charge
Institute of Ecology and Earth Sciences (UT)	In-kind	Costs for security staff for the extended opening hours for the building
Tartu Observatory (UT)	In-kind	mentoring, panel

Attendees and their roles

Hackathon participants

We aimed to increase the number of participants as compared to last year (36). At the start of the event we had 69 registrations with a turnout of 50 attending participants - mainly students. Most of them were students at the University of Tartu and came from at least 15 different countries of origin (Fig. 3). All on-site participants had to be registered with NASA.

Most participants were Bachelors and Masters students from the University of Tartu; with at least 20 participants from the department of Geography; 2 professional developers attended from outside of Estonia (Sweden, Latvia); and at least 5 participants came from different companies or other external organisations in Tartu. Within Tartu University, students came with various backgrounds, with large portions from Department of Geography, Institute of Computer Science, and Science and Technology. Furthermore, we had participants from Social Science, Business Administration and Environmental Technologies.

The final result, the solution, could be not only an app, but could also be a new dataset, a new method, a video or other story-telling approach. This hackathon format is different from the currently more prevalent technical business- and product-oriented hackathons in Estonia, like the popular Garage48 hackathons. However, the presented solutions this year were almost exclusively web applications/demo websites for mobile apps.

We also created an event website with the Sisu@UT webpage system at the University of Tartu, where we collated all information necessary for prospective participants: https://spaceapps2019.ut.ee

Figure 3: The map shows the countries of origin of the participants.

Mentors

We could win several mentors who agreed to be available to the teams during the event for technical questions, consulting and coaching in order to produce the best possible results.

Figure 4: (left to right) Martin Jüssi (CGI Estonia), Kaupo Voormansik (KappaZeta), Bruno Montibeller (PhD student Geoinformatics).

Figure 5: (left to right) Maria Angelica Medina Angarita (UT ATI), Stella Adamson (Freelance Graphics Designer).

Figure 6: Siim Karus (Software architect, Ministry of Finance), Mait Lang (Senior Research Tartu Observatory).

And from the Department of Geography the organisers themselves, Evelyn Uuemaa (Senior Researcher and Lecturer Geoinformatics), and Alexander Kmoch (EU H2020 Marie-Curie post-doctoral Research Fellow Geoinformatics) also joined the teams in every free minute to support and mentor them.

Panel and judgment criteria

At the end of the hackathon the teams presented (i.e. “pitch”) the results of their projects to the panel. This part of the event was public again and we had also guests from outside the event who were part of the panel.

We prepared scorecards for the panel in order to evaluate each team's performance in regards to following criteria, which were also promoted by NASA:

- Impact
- Creativity
- Validity
- Relevance
- Presentation
- Local / Global

We designated mentors and internal members of the organisers' units, the University of Tartu, Tartu Observatory and Tartu Science Park, as well as reaching out to various agencies and companies from Tartu and whole Estonia:

- Sven Lilla from the Tartu Science Park, who works every day with the ESA Space Business Incubator program at the Tartu Science Park;
- Martin Jüssi, CGI
- Margit Aun, Tartu Observatory
- Maria Angelica Medina Angarita, UT ATI
- Kaupo Voormansik, KappaZeta
- Stella Adamson, Freelance Media
- Evelyn Uuemaa, UT GEO

What happened on the Event?

Program

Friday, 20th of October:

At 5:00 pm we opened the check-in for participants, and at 6:00 pm we started the Welcome session: All gathered in the main auditorium. We started with some introductory words, explain the general program, the available locations and important housekeeping notes for the weekend.

As part of the Welcome session we had two expert Earth Observation / Satellite Data presentations:

Starting with Dr. Anu Reinart, the Director of the Tartu Observatory, who discussed the value of freely available satellite data and how applications of remote sensing can solve various challenges on Earth.

Figure 7: Event Kick-off at the big auditorium in Vanemuise 46, Institute of Ecology and Earth Sciences, Alexander Kmoch (overall introduction, l.), Dr Anu Reinart (m.), and Aimo Kõva, VP International Sales at AS Datel.

And followed by Aimo Kõva, the Vice President of International Sales at AS Datel, who demonstrated what type of applied remote sensing applications are used to solve immediate planning issues in the world's cities.

Figure 8: Dr. Anu Reinart from Tartu Observatory and Andreas Kiik (on short noticed Aimo Kõva presented by on behalf of Datel).

We introduced the mentors, who would be around on the hackathon for at least about 2 hours per day and give feedback about the work that teams have been doing.

Then suggested topics were presented in short pitches. Several topics were brought in by participants, and several were proposed by sponsoring companies or from UT scientists.

Teams had to comprise of people with different complimentary skills and have at minimum 3 up to 5 (in exceptional cases maybe 6) members. Eventually, from all pitched ideas, 8 teams could be formed successfully and we formally announced the start of the hacking time!

Figure 9: Friday activities, Kaupo Voormansik pitching the cloud mask challenge (l.u.), students pitch (l.l.) the MyBeach idea, teams forming (r.u.), and of course pizza :-)

On Friday and Saturday evenings the building (Vanemuise 46) had to be locked by 11:00pm and participants had to leave and were encouraged to get some sleep. On the mornings of Saturday and Sunday it was reopened at 8:00 am to the participants again.

Saturday, 21st of October was completely dedicated for hacking.

During the course of the event, the raised funding from sponsors was used to arrange food and drinks. Snacks, fruits and sandwiches were made available throughout the event, prepared by the volunteers. Friday dinner was pizza delivery sponsored by Datel, and Saturday and Sunday complete catering was sponsored by Tartu Science Park.

Sunday, 22st of October

Around noon we gave the teams a short upgrade on their pitching skills with a short presentation on things to consider to make the final presentation (the pitch).

4:00 pm (Final presentations and awards ceremony): All work had to stop, teams had to upload their results to public repositories like GitHub and update their dedicated NASA Space Apps project websites.

Everybody gathered in the main auditorium again. The teams then presented their results in fascinating captivating final presentations. Each team had a presentation of 3 to maximally 5 minutes. After the presentations the panel convened and graded all the teams by their presentation and results.

After the decisions were made the two winning teams were revealed and the prizes and certificates presented to the teams and the event concluded.

What are the Hackathon Outputs?

Team Projects

On the NASA Space Apps hackathon website, each hosting location got an own page for outreach and in order to present the projects of their 7 teams:

https://2019.spaceappschallenge.org/locations/tartu

The 1st price winning team "SPACEBEAVERS" with their idea and project "Floody". Their aim shifted slightly along the course of the hackathon. They set out to detect flooded areas using satellite (Sentinel 1 – aka radar-based), because spectral imagery was prone to cloud cover in particular on wet days. However, they did not reach the results they aimed for. They concluded with an historical inventory and a DEM-based predictive model, classifying different hazard levels for flood prone areas, and demonstrated the functionality in an interactive website.

The 2nd team, "DETECT LAND COVER CHANGE" (DLC), building an app that gives historical overview of the land cover changes using the Landsat and Sentinel databases. The main work was done by improving classification algorithms on Google Earth Engine, with results demonstrated on a web and mobile app.

Both 1st and 2nd team have been promoted to the NASA global competition, results still outstanding; however, several student team members of team Spacebeavers/Floody won't move forward; the team DLC expressed interest in keeping momentum, but had to acknowledge that they will have time constraints because of their on-going studies. The team lead of SpaceBeavers/Floody was a Latvian developer, who possibly could push the product forward.

Team "CLOUDLESS" worked on a deep-learning algorithm to improve cloud detection/masking for satellite data pre-processing and demonstrated substantial results.

Further noticeable projects include "FIELD VIEWER", which aimed to create an application for people working in agriculture sector. Their goal was to provide them information about the future climate and its effects on soil condition and crops quality. "SPACEHIKERS" were making a website where you can find different hiking, biking, mushroom picking, activities based on private and public forests in Estonia.

The team MyBeach aimed to develop an app that would help to make a decision at which beach in the next hours would be the best weather, in order to make best use of the few sunny Estonian summer days. And team DOG - DIGITIZE OCEAN GARBAGE developed an animated web site, where they visualised ocean currents and concentrations of plastic garbage in the oceans and a predictive model where sea turtle populations and high garbage concentrations would urge immediate clean up actions.

Several teams have also been approached by the Tartu Science Park/ESA Business Incubator program.

Media Outreach

Event-related posts on social media (especially on Twitter, Facebook and Instagram) were tagged with the **#SpaceAppsTartu** and **#SpaceApps** hashtag and connect add-tag **@** like @geograafia @spaceappschallenge and @teaduspark on Facebook, @tartugeo on Instagram and Twitter with handles and hashtags:
Tartu #SpaceAppsTartu @unitartu @teaduspark #SpaceApps @spaceapps.

ESA BIC Estonia at Tartu Science Park provided a free follow-up pre-incubator program for top teams utilizing ESA data sources (e.g. Copernicus data and processing tools: https://bit.ly/2kzND1S).

Facebook event page: https://www.facebook.com/events/2518789125042427/

And related photos on Facebook:
https://www.facebook.com/events/2518789125042427/?active_tab=discussion

Overall event discussion and conclusion

Goals set out:

The main goal was to provide a safe platform for motivated students from various backgrounds to work together on real problems in a hackathon event, while at the same time learning the benefits of interdisciplinary work, combined team work with different skills. Secondly, we were hoping to improve the event's profile, and attract a more mixed audience which would improve the quality and effectiveness of developed solutions. We worked closely with the Tartu Science Park in order to get more teams ready to enter the incubation program.

The second goal was to foster networking between the organising research institutes and the geospatial industry, business and technology environment in Tartu. Better inter-sectoral collaboration is of mutual benefit, exploiting science outputs and creating business value and making sure that Tartu continues to be a leading innovation hub.

Goals achieved:

Overall it can be concluded that this was a very successful event. The teams developed substantial solutions and got engaged with industry and entrepreneurship. Another very obvious take-away from this year's event was, that all solutions/projects were related to GIS and most applied satellite data to some extent.

It was refreshing and encouraging to see the diversity of participants, culturally, geographically as well as their varying educational and professional backgrounds. There were a lot of "domain experts", i.e. geography students with background in GIS and cultural, social or environmental expertise. However, given that most teams developed technical solutions such as web and mobile apps there was a lack of programmers. The challenge for them was to come together over a joint idea, combining their strengths and skills of different roles in order to produce something meaningful and valuable over the course of the weekend.

A particular challenge was finding consensus and compromises in their project design and decision making processes, while speaking different languages - not only in the literal sense (English was the main working language), but also in a professional sense. Students learned that it needed some effort and awareness to understand someone else's background and perspective in order to reconcile ideas and features between science experts, business and design people, and programmers. Participants reported

this as a very positive educational impact for them during and after the event. They valued the good working conditions, the diversity of the participants and project topics, but also experiencing the exposure to the pressure of tight problem-solving conditions during the hackathon.

Figure 10: Winning team SpaceBeavers (right) at price-giving (2 out of 5 present), price handed over by Sven Lilla from Science Park (centre in right image)

Also, the inter-departmental and inter-sectoral networking between the research institutes have been strengthened by the joint organising efforts. In addition, connections between the organising institutes and with Tartu Science Park/ESA Business Incubator and the geospatial software industry in Tartu have been improved.

Main challenges, what to improve, lessons learned:

When discussing the experiences of this year's Space Apps hackathon with the participating Geography students, we received mixed opinions. In summary, many of this year's participating geography students only attended to receive credits for courses, Start-up Seminar and Spatial Data Studio. We hoped to encourage them to get out of their comfort zone. To this effect we might have introduced students who were less motivated to provide substantial efforts during the hackathon and reduced quality or sustainability of outcomes. Some students also expressed that they would not want to create or work in a start-up but rather work in a "normal" company. We believe there is a lack of communication what start-up means and what the value of a hackathon is. This is something we propose to jointly develop better in the future with GIS, geospatial and/or satellite-data focused companies in regards to the curriculum and extra-curricular activities for students in this domain in order to prepare them better and get them more engaged.

Also non-computer science students believe that they don't have abilities/skills to contribute in such settings, if they aren't programmers. This misconception is still an important facet to overcome in order to get (eventually) domain specialists more involved early on and expose students to the field of geospatial and Earth Observation (EO) applications.

The Pitching training was received as very important and effective for the teams to improve their communication and presentation abilities.

Having to lock the building at night came with advantages and disadvantages: It was actually good for the performance of the students to be "forced" to leave and get some sleep. However, it was needed to plan accommodation for several visiting students from other locations because they couldn't stay at the event location. Sleeping at the event is rather typical for 48h hackathons and participants sleep a few hours "under the table".

Sustainability of the event and the event outcomes:

Although we had more participants and more teams overall, the actual number of teams who had follow-up activities with incubator program or industry are indicated to be less. Given, that this was the second instalment of this type of event, the general popularity of this hackathon was increased. We would like to highlight the support of Tartu Science Park/ESA BIC for this event and we hope to jointly continuing the activities around EO projects.

Thank You!

Figure 11: We thank all of the sponsors, supporters, and volunteers, who made this event not only possible, but a great success.