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Research Problem

- High-temperature weather conditions
- Urban Heat Island (UHI)
- Human thermal comfort
Research Problem

- UHI: A highly localized phenomenon
- Citizen-science environmental monitoring

Source: Overeem et al., 2013
Research Experiment

Human thermal comfort:
• Meteorological factors -> Measurements using a pocket weather meter
• Physiological factors -> Activity, clothing and personal information
Research Experiment

• Guided data processing
• Report on specific research questions

BRITEC: Ανάλυση δεδομένων 1ης μέτρησης: 11 Νοεμβρίου 2019

1. Διαφοροποίηση δείκτη θερμικής αίσθησης σε συνάρτηση με τον τόπο και τα χαρακτηριστικά αυτού (θερμοκρασία, υγρασία, ταχύτητα αέρα, νεφοκάλυψη)

ΟΜΑΔΑ 1

Σημείο 2: η θερμική αίσθηση της ομάδας είναι μεγαλύτερη από αυτή του σημείου 1 (σχετική σύλλογοι - προστίλλο σε σχέση)

Σημείο 3: η θερμική αίσθηση της ομάδας είναι μικρότερη από κάθε ένα δωρίζοντας των σημείων 1 και 2 (προστίλλο σε ηλίου). Σημεία 2 και 3: ιδία θερμοκρασία αέρα, ιδίο ποσοστό υγρασίας, Σημείο 3: 0,1 m/s ταχύτητα ανέμου

Σημείο 4: η θερμική αίσθηση της ομάδας είναι μικρότερη από όλα τα παραπάνω σημεία (δρόμος σε ηλίου) Σημείο 4: συνεχίζεται το ποσοστό της σχετικής υγρασίας σε σχέση με τα προηγούμενα (65,2%)

Σημείο 5: η θερμική αίσθηση της ομάδας αυξάνεται σε σχέση με το σημείο 4 αλλά παραμένει μικρότερη από τα παραπάνω. (δρόμος σε ηλίου)

Σημείο 6: η θερμική αίσθηση της ομάδας είναι μικρότερη από όλα τα άλλα σημεία και
Research Opportunities

Large-scale projects: e.g., BRITEC field experiment in several schools within a city (e.g., Athens, Greece) throughout a year

- Assistance in data collection (students)
- Assistance in project’s actions coordination (teachers)
- Acceleration of the research process
- Understand how people perceive our research -> Adapt communication and dissemination
Research Opportunities

- Extensive deployment of low-cost, citizen-science and/or crowd-sourced sensors and devices
- Wearable tools and smart gadgets

Source: Bailey et al., 2019

Source: Pető and Király, 2019

Source: Strobl et al., 2019

Source: European Schoolnet
Research Challenges

• Students’ participation and motivation
Research Challenges

- Adaptation and incorporation of a research project into the standard school programme (Particularity)
- Data quality
- Ethics (e.g., GDPR)
Summary

- Great experience
- Significant opportunities
- Manageable challenges
- Go for it!
Citizen science in the classroom

Collaboration with teachers

Adrián Gollerizo Fernández (Escuela IDEO, Madrid)
24th March 2021

The work presented in this document is supported by the European Commission’s H2020 programme – project BRITEC, coordinated by the Institute of Geophysics, PAS.
Introduction: Citizen science in the classroom

Citizen science projects in the classroom...

- Allow students to participate in advanced research, increasing academic performance.
- Introduce students into the process of science and the scientific method.
- Help develop positive attitudes towards science among students.
- Offer teachers an innovative approach to science learning and an enriching professional development opportunity.
A classroom experience: Cellspotting project

Cellspotting. *Let’s fight cancer together!*

Machine learning to classify microscopy images of cancer cells

**Biology**
- Microscopy cell images classification by humans

**Computer Science**
- Machine-learning platform

**Training**
- Train the computer with the human analysis

**Goal**
- Automatic Computer analysis
A classroom experience: Cellspotting project

Cellspotting. *Let’s fight cancer together!*

**Main goals:**

- To observe cell images obtained by fluorescence microscopy
- To sketch and legend the main components of the cell.
- To understand the apoptosis and necrosis processes and to identify the morphological characteristics of the two types of cellular death.
- To approach students to the techniques used in apoptosis-inducing drug delivery research in tumour cells
A classroom experience: Cellspotting project
A classroom experience: Cellspotting project

The project was implemented in Biology and ICT classes:

- Secondary Education: 3º ESO & 4º ESO
- Bachillerato: 1º & 2º Bachillerato
A classroom experience: Cellspotting project

Before starting...

- Previous lessons. The Cell (Biology) & Introduction to programming languages and machine learning (ICT)
- Lecture by the researcher (1)

Implementation of the project

- Cell analysis using Cellspotting:
  - Identify alive cells
  - Cell content release
  - Mitochondria distribution
  - Other remarks

After the implementation

- Lecture by the researcher (2)
- Evaluation
Lessons learned

Some of the lessons learned from this experience are:

● **Communication** between the researcher and the teacher is essential.
● **Communication** between the researcher and the students is very valuable.
● There should exist a **common goal**, shared by the teacher and the researcher.
● An effort should be made to link the **educational value** behind the project with the school’s educational project and the national educational curriculum.
● The researcher and the teacher should work together in the design of the **evaluation of the project**, from an educational point of view.
● The **sense of community** is very important for the students.
Citizen Science & Education: what about data?

Dr. Mieke Sterken
24/03/2021

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Citizen Science facilitator (40%)

[Image: https://momster.aeronomie.be/]
Radio Meteor Zoo on Zooniverse.org
Citizen Science facilitator (40%)

Citizen Science advisor (60%)

BRITEC
BRINGING RESEARCH INTO THE CLASSROOM

- Data Management
- Privacy & Ethics

KU LEUVEN

https://www.scivil.be/en
Citizen Science: a choice

Scientific knowledge
- Data gathering
- Data analysis
- Contribute to ‘real’ science

Societal impact
- Put things on political agenda
- Raise awareness
- Contribute to society
- Solving societal concerns

Education
- Learn
- Teach

Formal
- BRITeC

Informal
- BRITeC

Learn
- Bring Research into the Classroom

Participant motivations
- Be part of a community
- ‘Citizen Sensing’

Project goals
- BRITeC

Erasmus+
Citizen Science: a choice
- deliberate
- free
- motivations!

**Scientific knowledge**
- Data gathering
- Data analysis
- Contribute to ‘real’ science

**Education**
- Learn
- Teach
- Formal
- Informal

**Societal impact**
- Put things on political agenda
- Raise awareness
- Contribute to society
- Solving societal concerns

"Citizen Sensing"

**Project goals**
- Participant motivations

**Science**

**Education**
Citizen Science:
a choice
- deliberate
- free
- motivations!

This presentation: focus: DATA
They don’t register observations accurately

Motivation, Mindset

They have different interpretations

Obs – Interpr.

They make mistakes, e.g., they don’t register certain species

Knowledge

“Can we TRUST the data they retrieved?”
They don’t register observations (accurately)  Motivation, Mindset

They have different interpretations  Obs – Interpr.

They make mistakes, e.g., they don’t register certain species  Knowledge

**Solutions**

---

**Numbers**: duplications

**Numbers**: large sample sizes

**Protocol**: peer-review

**Protocol**: education on the topic

---

“Can we TRUST the data they retrieved?”
Curieuzeneuzen
(air quality)
20,000 participants

Duplication: 2 sampling units per participant
Solutions

Numbers: duplications

Eye for Diabetes
(Zooniverse)

replications: 10x (pre-study: 25x)

Radio Meteor Zoo (Zooniverse)

https://www.zooniverse.org/projects/zooniverse/radio-meteor-zoo/classify
**Solutions**

**Numbers:** large sample size

**GBIF**

Okt 2020: **1.6 billion observations** >5000 peer-reviewed papers
Solutions

Large sample sizes allow you to do post-systematization of your data

Opportunistic data vs. Systematic data

e.g., Biodiversity research, invasive species, climate change

6 per km²
No trend?

19 per km²
+ trend!

Bain 2016
Bird et al. 2014
Hill 2012
Isaac et al. 2014
Pocock et al. 2019
van Strien et al. 2013
Solutions

Opportunistic data vs. Systematic data e.g., Biodiversity research, invasive species, climate change

Large sample sizes allow you to do post-systematization of your data

Statistical solutions for error and bias in global citizen science datasets

Tomas J. Bird \textsuperscript{a,b,\*}, Amanda E. Bates\textsuperscript{b}, Jonathan S. Lefcheck\textsuperscript{c}, Nicole A. Hill\textsuperscript{b}, Russell J. Thomson\textsuperscript{b}, Graham J. Edgar\textsuperscript{b}, Rick D. Stuart-Smith\textsuperscript{b}, Simon Wotherspoon\textsuperscript{b}, Martin Krikosek\textsuperscript{d}, Jemima F. Stuart-Smith\textsuperscript{b}, Greta T. Pecl\textsuperscript{b}, Neville Barrett\textsuperscript{b}, Stewart Frusher\textsuperscript{b}

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**Abstract**

Networks of citizen scientists (CS) have the potential to observe biodiversity and species distributions at per km\(^2\) + trend!
Solutions

**Protocol:** peer-review

- By scientists
- By highly experienced amateurs
Protocol: education

Partnership for education:
a.o. Familiekunde Vlaanderen

https://mamamito.be/
They don’t register observations (accurately)

Motivation, Mindset

They have different interpretations

Obs – Interpr.

They make mistakes, e.g., they don’t register certain species

Knowledge

“Can we TRUST the data they retrieved?”

Numbers: duplications

Numbers: large sample sizes

Protocol: peer-review

Protocol: education on the topic

Advantages of working with schools
“Can we TRUST the data they retrieved?”

Advantages of working with schools

- **Numbers**: duplications
- **Numbers**: large sample sizes

Power of the numbers: 20-30 students per class

e.g. RMZ: ran out of data on Zooniverse last semester!

+ big EXTRA advantage: Time Series!

e.g. Fietsbarometer: streets covered because the students go to school anyway!
“Can we TRUST the data they retrieved?”

Advantages of working with schools

FIETSBAROMETER

- Numbers: duplications
- Numbers: large sample sizes
- Power of the numbers: 20-30 students per class

E.g. RMZ: ran out of data on Zooniverse last semester!
E.g. Fietsbarometer: streets covered because the students go to school anyway!
"Can we TRUST the data they retrieved?"

**Numbers:**
- duplications
- large sample sizes

**Protocol:**
- peer-review
- education on the topic

Power of the numbers: 20-30 students per class

Teachers as reviewers / dataguards
Advantages of working with schools
"Can we TRUST the data they retrieved?"

**Advantages of working with schools**

**Numbers:** duplications

**Numbers:** large sample sizes

**Protocol:** peer-review

**Protocol:** education on the topic

Power of the numbers: 20-30 students per class

Teachers as reviewers / dataguards

Teachers as educators/ambassadors: provide thorough training on the protocol

AND the motivation!
Ways of engaging

Harlin et al. 2018
Ways of engaging

=> Zooniverse

Radio Meteor Zoo

Harlin et al. 2018

Erasmus+ BRATEC

KU LEUVEN
Ways of engaging

1. Radio Meteor Zoo
   => Zooniverse

2. iNaturalist
   => Own platform

Harlin et al. 2018
Ways of engaging

Radio Meteor Zoo

iNaturalist

=> Zooniverse

=> Own platform

‘Oog voor Diabetes’

=> Teachers platform

Harlin et al. 2018

Erasmus+ BRATEC

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Ways of engaging

Harlin et al. 2018


Thank you!

Questions?
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