



Data — New Tools, New Codes, New Prospects

iDiv Annual
Conference 2019
Abstract book

Topic session 6
Friday, 30 August
9.00–10.45
Conference room 1CD

Joachim Denzler, *Session keynote*

Data Science for automatic monitoring in biodiversity research

Eduardo Arlé, *Standard talk*

bRacatus: an R platform to estimate the accuracy and biogeographical status of point-occurrence records

Steffen Ehrmann, *Standard talk*

Mapping global land-use patterns and recent historical changes

Rico Fischer, *Standard talk*

The relevance of forest structure for biomass estimations in temperate forests – new perspectives for remote sensing

Felicitas Löffler, *Standard talk*

How to increase dataset findability in Google? Enriching BEXIS2 data with schema.org entities

Ruben Remelgado, *Speed talk*

Macroecology and Society: First Steps of a Big Data Challenge

Petr Keil, *Speed talk*

Z-scores unite >70 pairwise indices of ecological similarity and association

Alexander Zizka, *Speed talk*

A global Red List of orchids stresses the reliability of automated conservation assessment to identify threatened species

Friederike Klan, *Speed talk*

Open Data Kit Goes Semantic - A Contribution to the Interpretability and Interoperability of Field Data

Tobias Meißner, *Poster*

What is the surface of a tree? Understanding branch surface to volume allometry using terrestrial laser scanning.

Matheus Colli-Silva, *Poster*

Cacao relatives reveal the effect of documentation bias on spatial patterns and conservation assessment in South America

Matthias Körschens, *Poster*

Deep Learning Approaches for Automatic Analysis of Plant Species and Coverage Determination

Sheeba Samuel, *Poster*

Provenance Management in BEXIS 2

Andreas Ostrowski, *Poster*

Beyond pure data management: research supporting software tools for BEXIS 2

Pawandeep Kaur, *Poster*

Towards a Knowledgebase based Visualization Recommendation Approach for Biodiversity Data

Alsayed Algergawy, Poster

OMICs data management in AquaDiva

Christopher Hutengs, Poster

Rapid characterisation of soil biomass and soil physicochemical properties with vis-NIR and mid-IR diffuse reflectance spectroscopy

Reed Anderson, Demonstration

Use a smartphone to capture 3D representations of grasslands

Jhonatan Contreras, Poster

Automatically Estimating Forestal Characteristics in 3D Point Clouds using Deep Learning

HyeJin Kim, Workshop

Integrated modelling for multi-scale Nature Futures

Xuanlong Ma, *Workshop*

Trait and more: what functional aspect of plant diversity
can we remotely sense?



iDiv Annual Conference 2019

**Topic Session 6: Data - New Tools, New Codes, New Prospects, 30 Aug.,
09:00 - 10:45**

Session keynote

Denzler, Joachim

Friedrich Schiller University Jena

Data Science for automatic monitoring in biodiversity research

More and more projects in biodiversity research are supported by (semi-)automatic recordings with sensors of different modalities, for example the Ecotron installation. This huge amount of probably continuously collected data not only need to be managed but analyzed as well. Today, this data can no longer be analyzed and studied by the researcher by hand. We present current state of the art and success stories in extracting knowledge from data by means of data science and machine learning. In particular, we show the potential of automatic monitoring, the benefits as well as preliminaries to guide researchers that consider applying modern machine learning methods to their data. This makes it possible to classify and detect species in images, to observe anomalies in data, to measure information, like biomass, or to detect causal relationships. In the presentation, we establish links from data management to machine learning as well. Collected data if annotated the right manner will be a much more valuable resource for later analysis. As an outlook of those activities we summarize shortly three projects within or close to the area of biodiversity research that started recently within the "Virtuelle Werkstatt für die Wissenschaften" funded by the Zeiss foundation.

Co-Authors:

Denzler, Joachim

Topic Session 6: Data - New Tools, New Codes, New Prospects, 30 Aug., 09:00 - 10:45

Standard talk

Arlé, Carlos Eduardo

Leipzig University

bRacatus: an R platform to estimate the accuracy and biogeographical status of point-occurrence records

Understanding species distributions is critical for addressing manifold ecological questions, but available data are typically highly heterogeneous and rife with various information gaps and uncertainties. Crucially, the accuracy and biogeographical status (native vs. alien) of individual data points is often unclear, thus challenging their confident use in distribution modelling or other downstream analyses. We developed a framework, currently being implemented as an R package, for estimating the accuracy and biogeographical status of a given occurrence record. We developed and tested our methods based on 400 terrestrial species representing four taxa. The estimation is based on the spatial context provided by coarser-grain reference regions of native and/or alien distributions. By estimating records' likelihoods along two axes, i) "certainly false to certainly true", and ii) "certainly native to certainly alien", the framework avoids the artificial thresholds of simplistic data filtering and instead allows propagating uncertainties in subsequent analyses. We trained and tested different models with independent datasets, adopting the one that showed the best predictive power ($AUC \approx 0.8$). This package provides support for researches working with SDMs, biogeographical patterns and other analyses that rely on point-record/plot data. I will present this tool and discuss its performance for different data sources.

Co-Authors:

Arlé, Eduardo; Essl, Franz; Keil, Petr; Knight, Tiffany; Weigelt, Patrick; Winter, Marten; Zizka, Alexander; Meyer, Carsten

Topic Session 6: Data - New Tools, New Codes, New Prospects, 30 Aug., 09:00 - 10:45

Standard talk

Ehrmann, Steffen

Leipzig University

Mapping global land-use patterns and recent historical changes

Land-Use is one of the big drivers both of biodiversity patterns and of the loss of biodiversity. The burgeoning global human population needs to agree about trade-offs between food security and biodiversity conservation. Despite their bearing, key land-use variables are rarely available as historical time-series, are not mutually consistent and suffer generally from low precision and accuracy. The Land-Use Change Knowledge Integration Network (LUCKINet), organised and lead by iDiv's Macroecology and Society group, develops a collaborative open-science IT infrastructure based on modularized algorithms with the aim to provide a new generation of global, annual, mutually consistent, data-driven and quality-assured gridded datasets for several important land-use variables. We envision to engage a growing network of contributors from the wider community in land-system science to successively increase the list of covered land-use variables, consolidate and improve the employed techniques and to make use of the data. We present the current state of our efforts, which should include an (operational) alpha-version of the gridded time-series of several cropping, grazing, and forestry related variables with mutual statistical, spatial and temporal consistency spanning the past 2-3 decades.

Co-Authors:

Ehrmann, Steffen; Amatulli, Giuseppe; Bernard, Lars; Da Re, Daniele; Fritz, Steffen; Gentile, Alessandro; Gilbert, Marius; Mäs, Stephan; Rosa, Isabel; Ramankutty, Navin; Shen, Longzhu; Schulze, Katharina; Seppelt, Ralf; Verburg, Peter; Wolf, Florian; You

Topic Session 6: Data - New Tools, New Codes, New Prospects, 30 Aug., 09:00 - 10:45

Standard talk

Fischer, Rico

Helmholtz Centre for Environmental Research GmbH - UFZ

The relevance of forest structure for biomass estimations in temperate forests – new perspectives for remote sensing

Forests provide important ecosystem services such as carbon sequestration. Forest landscapes are intrinsically heterogeneous - a problem for biomass assessment using remote sensing. For the improved estimation forest structure constitutes valuable additional information. However, survey of forest structure by remote sensing remains a challenge which results mainly from the differences in forest structure metrics derived by using remote sensing compared to classical structural metrics from field data.

To understand these differences, remote sensing measurements were linked with an individual-based forest model. Forest structure was analyzed by lidar remote sensing using metrics for the horizontal and vertical structure. To investigate the role of forest structure for biomass estimations in temperate forests, 25 lidar metrics of 375,000 simulated forest stands were analyzed.

Top-of-canopy height arose as the best predictor for describing horizontal forest structure. The standard deviation of the vertical foliage profile was the best predictor for the vertical heterogeneity of a forest. In particular, horizontal structure was essential for forest biomass estimation.

Future remote-sensing missions will have the capability to provide information on forest structure (e.g., from lidar or radar). This will lead to more accurate assessments of forest ecosystem services.

Co-Authors:

Fischer, Rico; Knapp, Nikolai; Bohn, Friedrich; Shugart, Herman H.; Huth, Andreas

iDiv Annual Conference 2019

Topic Session 6: Data - New Tools, New Codes, New Prospects, 30 Aug., 09:00 - 10:45

Standard talk

Löffler, Felicitas

Friedrich Schiller University Jena

How to increase dataset findability in Google? Enriching BEXIS2 data with schema.org entities

Nowadays, an increasing amount of research data is re-used (GBIF Science Review 2018, <https://doi.org/10.15468/VA9B-3048>). Hence, finding relevant datasets is getting more and more important and challenging for scholars. In order to increase data findability in search applications, the RDA Data Discovery Group recommends enriching metadata with additional descriptions from schema.org (<https://schema.org/>) and bioschema.org (<https://bioschemas.org/>). These metadata extensions allow categorization of content parts (e.g., to specify IDs, location, taxon and temporal information explicitly) and linkage to terminology resources. That additional information supports external search providers such as Google (<https://toolbox.google.com/datasetsearch>) to better find and index research data. It also allows improved data filtering and offers the potential to search for specific categories.

In this presentation, we will introduce our approach for enriching BEXIS2 data with schema.org entities. We will present the current results for public metadata from iDiv (<https://idata.idiv.de/>) and we will demonstrate how these extensions can increase data findability.

Co-Authors:

Grygorova, Elena; Müller, Friedrich; Hohmuth, Martin; Schöne, David; Löffler, Felicitas; König-Ries, Birgitta



iDiv Annual Conference 2019

**Topic Session 6: Data - New Tools, New Codes, New Prospects, 30 Aug.,
09:00 - 10:45**

Speed talk

Remelgado, Ruben

Leipzig University

Macroecology and Society: First Steps of a Big Data Challenge

Nowadays, ecologists have broad open-access to spatial data products. This data comes from official institutions but also from scientists that use cloud storage facilities to promote their work. This tendency opens the path to a new scientific era powered by Big Data. However, it also brings organizational issues.

Traditionally, research develops on a closed loop. Within a project, scientists address data needs when prompted and customize their data to the work at hand. However, within a research lab, this can hinder progress as other current - and future - projects might require the same data.

In the Macroecology and Society group, we face such issues. As we address global ecological questions, our members often need similar datasets and our ability to share them is essential to avoid work repetitions and test new hypothesis. To achieve this, we created a homogenized data infrastructure on which existing and future projects can run their experiments. Moreover, we built an R package to query and access existing data and provide algorithms to analyze it on an HPC platform with minimal user input.

In this talk, we provide a glimpse into our data infrastructure as well as into its current contents.

Co-Authors:

Remelgado, Ruben; Meyer, Carsten



iDiv Annual Conference 2019

**Topic Session 6: Data - New Tools, New Codes, New Prospects, 30 Aug.,
09:00 - 10:45**

Speed talk

Keil, Petr

Martin-Luther-University Halle-Wittenberg

Z-scores unite >70 pairwise indices of ecological similarity and association

Pairwise ecological resemblance, which includes beta diversity and associations between species (co-occurrence), can be measured by >70 indices. Examples for binary presence-absence data are Jaccard or Sorensen indices, C-score, simple matching coefficient, or Forbes association. All of them can be expressed using contingency table matching components a, b, c and d - the joint presences, presences at only one site/species, and joint absences. Here I demonstrate that most of the indices have almost identical ability to accurately capture the true resemblance, as long as they are calculated as a Z-score, i.e. as deviation of the index from a null expectation. Further, I show that Z-scores improve the accuracy of capturing the true resemblance, compared with raw forms of the indices. Finally, I prove that any single of the matching components, when expressed as Z-score, can alone be used as an index that performs equally good as the classical indices; this also includes joint absences (double zeroes). All this simplifies selection of the "right" index in the field flooded with indices, it underscores the advantage of expressing similarity and association as deviation from a null expectation, and it revives the potential of joint absences (double zeroes) as a meaningful ecological quantity.

Co-Authors:

Keil, Petr



iDiv Annual Conference 2019

**Topic Session 6: Data - New Tools, New Codes, New Prospects, 30 Aug.,
09:00 - 10:45**

Speed talk

Zizka, Alexander

Leipzig University

A global Red List of orchids stresses the reliability of automated conservation assessment to identify threatened species

Automated conservation assessments based on publicly available geographic occurrence records are a rapid alternative to resource-intensive Red List assessments to prioritize global conservation needs. However, it is unclear how accurate and biased automated assessments are. Here, we present the results from >14,000 species of the orchid family (Orchidaceae) demonstrating that automated conservation assessments can identify possibly threatened species with an accuracy of around 80% compared to global Red Lists in a fraction of the time. Furthermore, the automated assessment reduced evaluation bias present in Red List assessments. Hence, automated assessments are a critical tool to reach the goal of a global extinction risk assessment for all known species and improve the prioritization of conservation effort.

Co-Authors:

Zizka, Alexander; Vitt, Pati; Knight, Tiffany



iDiv Annual Conference 2019

**Topic Session 6: Data - New Tools, New Codes, New Prospects, 30 Aug.,
09:00 - 10:45**

Speed talk

Klan, Friederike

German Aerospace Center (DLR)

Friedrich Schiller University Jena

Open Data Kit Goes Semantic - A Contribution to the Interpretability and Interoperability of Field Data

In citizen science and field research, data collection via mobile applications is playing an increasingly important role. A wide range of software frameworks have emerged, which allow to easily create and distribute form-based surveys for collecting data via mobile applications. Although these frameworks support scientists in designing and conducting data collection surveys, data export is usually limited to tabular standard formats such as CSV or Excel. The attached metadata is rather scarce, so the semantics of the data (what was measured/observed?) often remains unclear. This limits the reuse of the collected data beyond their initial usage context, as interpretability and integration with other data is hampered. In our talk, we introduce a methodology we developed and a software tool that allows researchers to easily enrich their forms for campaigns with semantic annotations and flexibly export the collected data into user-defined formats. In addition to classical description languages such as XML, export to the W3C standard RDF (Linked Open Data) is supported. This enables to link data with their machine-readable meaning. The software implementation of the method was realized as an extension of the widely used data collection framework Open Data Kit 1 (ODK1) and is freely available as open source.

Co-Authors:

Steinberg, Markus Daniel; Schindler, Sirko; Klan, Friederike



iDiv Annual Conference 2019

**Topic Session 6: Data - New Tools, New Codes, New Prospects, 30 Aug.,
09:00 - 10:45**

Poster

Meißner, Tobias

Leipzig University

What is the surface of a tree? Understanding branch surface to volume allometry using terrestrial laser scanning.

The surface area exposed by branches of tree canopies has significant implications for many ecophysiological processes such as stem respiration and the interception of light and rain, but it also provides the habitat area for colonization of numerous taxa such as lichens, algae and bark-dwelling arthropods. Despite its high ecological relevance, the surface characteristics of tree canopies remain so far understudied, because of the high effort needed to quantify this architectural trait accurately and in a non-destructive way. We thus propose a semi-automatic method based on terrestrial LiDAR scans (TLS) in order to extract architectural information of seven European tree species in an alluvial forest at the Leipzig Canopy Crane research site. First, we developed a method that detects individual trees from the LiDAR point-cloud automatically. Then, we computed three-dimensional quantitative structure models (QSM) out of the LiDAR point cloud testing different segmentation methods. Further, we calculate the volume and surface area by branch order out of the QSMs. This will finally enable us to develop for the first time allometric equations needed to quantify surface area distribution in the complex three-dimensional ecosystem compartment of tree crowns for biodiversity and ecophysiological research.

Co-Authors:

Meißner, Tobias; Richter, Ronny; Engelmann, Rolf; Steinecke, Claudia; Wirth, Christian

Topic Session 6: Data - New Tools, New Codes, New Prospects, 30 Aug., 09:00 - 10:45

Poster

Silva, Matheus Colli

University of São Paulo

Cacao relatives reveal the effect of documentation bias on spatial patterns and conservation assessment in South America

The fast increase availability of primary biodiversity data has changed the analysis of biogeographical patterns. Nevertheless, collection bias prevents the use of full potential of such data for biogeographic research, especially in poorly sampled areas, as large portions of South America. Here, we selected 11 genera from the cocoa family (Byttnerioideae, Helicterioideae & Sterculioideae subfamilies, Malvaceae) as models to explore the impact of bias on spatial patterns. We test if two datasets of species distribution – one manually curated in tedious work, and one obtained from GBIF (www.gbif.org), subjected only to automatic cleaning procedures – perform differently in identifying large-scale distribution patterns and understanding the representation of our target species in protected area network of South America. Furthermore, we test if these datasets differed in their ability to characterize species' environmental niches. The overall species richness patterns were similar between two datasets. Furthermore, estimated environmental niches the representativeness of records and country-level endemism were also similar and in both datasets most countries had most of their species inside protected areas, although the collection number is scarce. We found dissimilarities among datasets in the Amazon, where collection bias was high. We discuss the results in light of the conservation prospects in the area.

Co-Authors:

Colli-Silva, Matheus; Zizka, Alexander

iDiv Annual Conference 2019

**Topic Session 6: Data - New Tools, New Codes, New Prospects, 30 Aug.,
09:00 - 10:45**

Poster

Körschens, Matthias

Friedrich Schiller University Jena

Deep Learning Approaches for Automatic Analysis of Plant Species and Coverage Determination

Due to the increase of anthropogenic influence in nature, especially with regard to climatic change, monitoring plants and animals is becoming increasingly important to quantify the impact of humans on the natural environment and methods for successful nature conservation.

Continuous monitoring can be extremely laborious and time-consuming due to the large amounts of data that ideally have to be recorded and analyzed in the process, especially, if a large number of different species are being observed.

Due to the recent development of Convolutional Neural Networks (CNNs), which can extract information from images and other data, parts of the analysis processes can be automated to aid field researchers.

Nowadays CNNs are already applied in many different scenarios, but in biodiversity research this technology is still vastly underutilized, despite having a large number of possible applications.

We are developing and presenting a system using CNNs for automatic analysis of the coverage in images of, for example, vegetation plots, with the aim of extending it to also cover the phenology of the plants. Such a system will make the analysis of large amounts of image data feasible and time efficient. The system is developed in an interdisciplinary fashion in a cooperation between biologists and computer scientists.

Co-Authors:

Körschens, Matthias; Römermann, Christine; Bucher, Solveig Franziska; Ulrich, Josephine; Denzler, Joachim



iDiv Annual Conference 2019

Topic Session 6: Data - New Tools, New Codes, New Prospects, 30 Aug., 09:00 - 10:45

Poster

Samuel, Sheeba

Friedrich Schiller University Jena

Provenance Management in BEXIS 2

Computation and analysis of scientific data are a major part of research work for most scientists. New datasets and results are generated with these computations. For the reuse and reproducibility of these results, it is important that their provenance is captured and managed. Recently, computational notebooks have gained widespread adoption among scientists from different disciplines because they combine data and code along with the results. In our research work, we integrate computational notebooks and provide provenance management of the datasets generated from these notebooks in BEXIS 2. With this workflow, scientists can perform computations by directly accessing the datasets from a BEXIS 2 instance like the iDiv Data Repository (<https://idata.idiv.de>) using the APIs in these notebooks. Users can upload the generated results from these computations to the BEXIS 2 instance along with the provenance information. The new dataset contains the primary data, the metadata, and provenance information. The provenance information includes the different executions of the Jupyter Notebooks which is collected using the ProvBook tool. It also includes information about the datasets that were used in the script to generate the new dataset like version, author, etc. We also provide a visualization of the provenance information in BEXIS 2.

Co-Authors:

Nmerenu, Chima; Dabat, Jihad; Schöne, David; Samuel, Sheeba; König-Ries, Birgitta

Topic Session 6: Data - New Tools, New Codes, New Prospects, 30 Aug., 09:00 - 10:45

Poster

Ostrowski, Andreas

Friedrich Schiller University Jena

Beyond pure data management: research supporting software tools for BEXIS 2

BEXIS 2 is a data management platform facilitating research data management in biodiversity, ecology, and adjacent domains. It provides functionalities of a modern data management system following the data-life-cycle concept and aims to facilitate data sharing and data reuse. BEXIS 2 is fully modularized which allows implementing self-developed features and enhancing the system with further functionalities.

Within the Biodiversity Exploratories project, we developed a couple of additional functionalities to facilitate the collaboration between people and to provide extended infrastructural support to the project as a whole. It involves fieldwork management related features like resource booking management, and a tool to graphically manage research areas and field sites. Further features are related to event management, information/document sharing, and photography exchange. We also extended BEXIS 2 with data related features. We implemented a land use intensity (LUI) calculation tool, and integrated a third party on-demand processing climate data application. With such functionalities, BEXIS 2 goes beyond conventional data management.

The development follows a generic, modular and extensible approach. Therefore, these modules are adaptable to project specific needs and could be of high interest for other BEXIS 2 instances like the iDiv Data Repository.

Co-Authors:

Ostrowski, Andreas; Fürstenau, Cornelia; Petzold, Eleonora; Zander, Franziska

Topic Session 6: Data - New Tools, New Codes, New Prospects, 30 Aug., 09:00 - 10:45

Poster

Kaur, Pawandeeep

Friedrich Schiller University Jena

Towards a Knowledgebase based Visualization Recommendation Approach for Biodiversity Data

Information visualization is important in science as it helps scientists in exploring, analyzing, and presenting both the obvious and less obvious features of their datasets. We did a study on biodiversity scientists to know their visualization practices and requirements. Our study revealed that although biodiversity researchers feel comfortable with their current visualization practices, they wish to have software support to choose appropriate visualizations to represent their data. Significant challenges arise from a large number of visualizations available today and from the increased size and complexity of the data to visualize. The details of our study will be presented in our poster.

Along with that, we will also inform our work in progress on biodiversity visualization recommendation tool. Applying the principles of the knowledge-assisted visualization system, we are using biodiversity domain knowledge as the base for our recommendation engine. We are constructing this knowledgebase by applying different machine learning methods on the visualization captions available in the biodiversity publications. In our poster, we will give details about our approach to biodiversity knowledgebase based visualization recommendation system

Co-Authors:

Kaur, Pawandeeep



iDiv Annual Conference 2019

**Topic Session 6: Data - New Tools, New Codes, New Prospects, 30 Aug.,
09:00 - 10:45**

Poster

Algergawy, Alsayed

Friedrich Schiller University Jena

OMICs data management in AquaDiva

Within the context of AquaDiva, a large Collaborative Research Centre covering a variety of research fields such as biology, geology, and chemistry and computer science, there is a growing increase in the amount of biological data generated using omics techniques, which can be categorized in general into primary and secondary data. The primary (raw) data can be FASTQ files for sequencing technology or others. These files (raw data) can be usually stored in public repositories, such as GEO (<https://www.ncbi.nlm.nih.gov/geo/>), SRA (<https://www.ncbi.nlm.nih.gov/sra>), or PeptideAtlas (<http://www.peptideatlas.org/>), where big volumes of data are stored with different formats. In order to achieve the integration and interoperability between AquaDiva datasets, we are developing and introducing a new component within ADOOnIS (AquaDiva Ontology-based Information System) that establishes a link between AquaDiva data portal and a number of these public repositories. In particular, given the accession number of a dataset, we extract the relevant metadata and create a new dataset at the AD portal including the link to the primary data.

Co-Authors:

Hamed, Hamdi; Tskhvedadze, Giga; Noack, Antonio; blaa, David; loeffler, Felicitas; Algergawy, Alsayed; Koenig-Ries, Birgitta

Topic Session 6: Data - New Tools, New Codes, New Prospects, 30 Aug., 09:00 - 10:45

Poster

Hutengs, Christopher

Leipzig University

Rapid characterisation of soil biomass and soil physicochemical properties with vis-NIR and mid-IR diffuse reflectance spectroscopy

Soil microbial biomass plays a critical role for the maintenance of soil ecosystem functions as soil organisms mediate, e.g., the storage of soil carbon, the mineralisation of plant material, and the stabilisation of soil aggregates. Lab analytical methods to determine soil microbial biomass and key physicochemical soil constituents linked to its composition, such as OC, N, pH, carbonates or clay minerals, can be time-consuming and expensive, limiting the efficient monitoring of long-term biodiversity-ecosystem functioning experiments or the detailed analysis of microbial soil properties at the landscape scale. Soil spectroscopy may provide a rapid and cost-efficient alternative to characterise soil microbial biomass (e.g. fungal-to-bacterial biomass ratio) and its interaction with the soil environment. We explored the potential of vis-NIR and mid-IR diffuse reflectance spectroscopy to analyse soil microbial biomass composition and soil physicochemical properties for 164 soil samples collected from the Jena Experiment to facilitate the monitoring of biodiversity-ecosystem function experiments.

Co-Authors:

Hutengs, Christopher; Eisenhauer, Nico; Schädler, Martin; Weigelt, Alexandra; Vohland, Michael

Topic Session 6: Data - New Tools, New Codes, New Prospects, 30 Aug., 09:00 - 10:45

Demonstration

Anderson, Reed

Helmholtz-Centre for Environmental Research - UFZ

Martin-Luther-University Halle-Wittenberg

Use a smartphone to capture 3D representations of grasslands

Plant diversity and productivity are two key Essential Biodiversity Variables (Pereira et al. 2013; Kissling et al. 2018) that are required to quantify changes in community composition and ecosystem function. These variables are standard measurements for terrestrial ecological monitoring efforts, but the acquisition of these data involves time-consuming or destructive sampling that greatly limits the spatial and temporal resolution of data needed to detect trends of ecosystem change. Here I demonstrate an in-situ field protocol to capture grassland structural attributes using a smartphone and image-based structure-from-motion (SfM) photogrammetry; this is a promising new measurement technique for grassland plot experiments (Anderson et al., 2019, in prep). The demonstration includes active participation from conference attendees using a smartphone and generalized scale bar setup on a mock grassland plot sized 2 x 2 m. Smartphones, along with a setup including elevated scale bars, can capture structural attributes of grassland plots, and show promise as a method for non-destructive sampling of grassland biomass, and thus allow greater sampling frequency while providing novel data on vegetation structure that is not otherwise feasible.

Co-Authors:

Anderson, Reed



iDiv Annual Conference 2019

**Topic Session 6: Data - New Tools, New Codes, New Prospects, 30 Aug.,
09:00 - 10:45**

Poster

Contreras, Jhonatan

Friedrich Schiller University Jena

German Aerospace Center DLR

Automatically Estimating Forestal Characteristics in 3D Point Clouds using Deep Learning

Biodiversity changes can be monitored using georeferenced and multitemporal data. Those changes refer to the process of automatically identifying differences in the measurements computed over time. The height and the Diameter at Breast Height of the trees can be measured at different times. The measurements of individual trees can be tracked over the time resulting in growth rates, tree survival, among other possible applications. We propose a deep learning-based framework for semantic segmentation, which can manage large point clouds of forest areas with high spatial resolution. Our method divides a point cloud into geometrically homogeneous segments. Then, a global feature is obtained from each segment, applying a deep learning network called PointNet. Finally, the local information of the adjacent segments is included through an additional subnetwork which applies edge convolutions. We successfully train and test in a data set which covers an area with multiple trees. Two additional forest areas were also tested. The semantic segmentation accuracy was tested using F1-score for four semantic classes: leaves (F1 = 0.908), terrain (F1 = 0.921), trunk (F1 = 0.848) and dead wood (F1 = 0.835). Furthermore, we show how our framework can be extended to deal with forest measurements such as measuring the height of the trees and the DBH.

Co-Authors:

Contreras, Jhonatan; Sickert, Sven; Denzler, Joachim