

# ANKÜNDIGUNG

## **Berufungsvortrag „Archäoinformatik“ am 04.12.2017**

Am **04.12.2017 um 08:00 Uhr** hält  
Herr Prof. Dr. rer. nat. habil. Matthias Alexander Renz seine  
Berufungsvorträge.

**Ort:** Institut für Informatik, Raum: LMS Ü 2,  
Ludewig-Meyn-Straße 2, 24118 Kiel

1. **„Binäre Suche“ (Zielgruppe: 2. Semester Bachelor Informatik)**
2. **„Towards Archaeological Data Science:  
Managing, Querying and Mining Heterogeneous and Uncertain  
Data“**

Zusammenfassung zu 2):

Recent advances of sensor technologies, the increasing availability of data and methods for managing complex and heterogeneous data, coupled with the new user mentality of generating and voluntarily sharing information produce a tremendous source of rich data. We are getting increasing access to diverse sources of data ranging from personal (private) data, like restaurant ratings, wiki articles, photos, videos and social network information, via industry related data, to scientific data provided by almost all scientific disciplines. This data covers information which is very useful for an incredible number of applications in academia, industry, and society. However it is often very difficult to discover the knowledge of interest due to the inherent complexity, imprecision and often incompleteness of the data. In order to take advantage of this vast amount of rich but sometimes hidden and hard-to-retrieve information, we need special, scientific-domainjustified methods allowing us to search and discover domain-relevant information and knowledge in an effective and efficient way. In my talk, I will introduce an excerpt of my studies in the context of Data Science. I will first introduce two multi-disciplinary projects on archaeo-zoological data science, one is about 3D-shape-based classification of bone findings and the other is on locationbased data mining for studies on transalpine mobility and cultural transfer in prehistory. Then, I will go more into detail about a proaches for probabilistic query processing on uncertain spatiotemporal data (trajectories) while focusing on efficient query processing and data management. Finally, I will conclude my talk with an overview of research directions and projects.

# ANKÜNDIGUNG

## **Berufungsvortrag „Archäoinformatik“ am 04.12.2017**

Am **04.12.2017 um 11:00 Uhr** hält  
Herr Dr.- Phil. Eike Anderson seine Berufungsvorträge.  
**Ort:** Institut für Informatik, Raum: LMS Ü 1,  
Ludewig-Meyn-Straße 2, 24118 Kiel

- 1. „Binäre Suche“ (Zielgruppe: 2. Semester Bachelor Informatik)**
- 2. „Procedural Synthesis & Shape Grammars for Cultural Heritage Visualisation and Digital Fabrication“**

Zusammenfassung zu 2):

This talk will focus on methods and techniques of the visual computing domain that can aid both digital and physical (tangible) preservation and dissemination of cultural heritage objects. Modern virtual environments, such as those used in interactive cultural heritage visualisations, just like those used in computer games, are content rich and their audiences expect to be presented with virtual worlds that are highly detailed and that can be perceived as real. In many cases the manual creation of all world elements would be too time consuming and/or too expensive, and some objects or elements of objects may be unsuitable for manual creation, which can be solved through the application of procedural synthesis, i.e. the automatic generation of virtual environment content.

In recent years, a popular approach to the procedural generation of cities and buildings has been the use of so-called shape grammars that are then interpreted by a generative modelling system which emits models that can be deployed in virtual environments as found in game, or film production. Shape grammars describe objects in terms of their constituent shapes and sets of rules that include shape combinations (e.g. CSG – Constructive Solid Geometry – operations), spatial relationships and various transformations of the shapes. They have been used successfully for the digital reconstruction of historical buildings and ruins, and in this architectural context they can be defined to create digital artefacts that adhere to a specific architectural style. An example for this would be the procedural generation of Roman buildings and urban developments based on the architectural rules described by Vitruvius.

Computer implementations of shape grammars typically use a boundary representation (B-Rep) to generate initial and final shapes, which restricts the operations (e.g. Boolean operations such as intersections) and application areas of the generated models. Many of these limitations can be overcome by representing objects differently, namely using Function representation (F-Rep), which simplifies many complex shape operations that otherwise would be hard or impossible to achieve. Resulting objects can be converted to the type of discrete surface representation used in virtual environments for visualisation using well-established methods, but the F-Rep parametric volume representation also lends itself to the generated object's digital fabrication, such as the additive manufacturing process of 3D printing, which can e.g. be (and has been) applied to cultural heritage preservation.

# ANKÜNDIGUNG

## **Berufungsvortrag „Archäoinformatik“ am 04.12.2017**

Am **04.12.2017 um 14:00 Uhr** hält  
Herr Dr.- Phil. Tom Brughmans seine Berufungsvorträge.  
**Ort:** Institut für Informatik, Raum: LMS Ü 2,  
Ludewig-Meyn-Straße 2, 24118 Kiel

1. „Binäre Suche“ (Zielgruppe: 2. Semester Bachelor Informatik)
2. „Understanding long term change in market economies: spatial and temporal agent-based simulation modelling of the Roman economy”

Zusammenfassung zu 2):

What economic trends are only revealed over centuries long timescales? What aspects of human behaviour are responsible for generating such trends? The Roman Empire is the only well-documented example of economic change over centuries within a single political system. Current models in economics lack the time depth necessary to evaluate long term effects of regulation and free-market trade: Roman economy studies could inform these models. However, the ability of Roman economy studies to make such crucial contributions is currently impossible due to *two issues*: (1) the limited use of the available big archaeological datasets; (2) the limited development and application of computational simulation modelling.

I will present my research efforts in tackling these two issues and making computational comparisons between the Roman economy and modern economies possible for the first time, by illustrating my work on agent-based simulation modelling of Roman economic integration and social networks tested against a large archaeological dataset of Roman ceramic tableware. Diverging perspectives on the degree and mechanisms of Roman economic integration currently dominate debates on the Roman economy. How important were the social networks that structured the flow of commercial information around the Empire? How did family, religious, commercial and institutional community networks affect this flow? To address these questions an agent-based network model was created called MERCURY, after the Roman patron god of commerce (Brughmans and Poblome, 2016a-b). In MERCURY, agents represent commercial actors that are distributed among markets and connected in a social network with small-world network properties within each market (implementation following Jin et al. 2001) but a variable proportion of links between markets. Agents can trade Roman tableware, informed by the commercial information they collect through their social network. In experiments, differing degrees of market integration are tested by varying the proportion of inter-market links and comparing simulated tableware distributions with archaeologically observed ones.

I will further illustrate my ongoing work in elaborating on MERCURY by evaluating the effects of the Roman transport system, scaling in populations of urban settlements, and copying mecha-

nisms of market strategies. Moreover, I will present the educational resources being prepared in my current project to enable archaeologists, historians and economists to tackle the above-mentioned issues. The long term goal of this line of research is to better understand what aspects of human behaviour only reveal economic trends over centuries long timescales and ultimately to make long term projections for present-day economies and inform long-term economic policies.

References cited:

Brughmans, T., & Poblome, J. (2016a). Roman bazaar or market economy? Explaining tableware distributions through computational modelling. *Antiquity*, 90(350), 393–408. doi:10.15184/aqy.2016.35

Brughmans, T., & Poblome, J. (2016b). MERCURY: an agent-based model of tableware trade in the Roman East. *Journal of Artificial Societies and Social Simulation*, 19(1), <http://jasss.soc.surrey.ac.uk/19/1/3.html>.

Jin, E. M., Girvan, M., & Newman, M. E. (2001). Structure of growing social networks. *Physical review. E, Statistical, nonlinear, and soft matter physics*, 64(4 Pt 2), 46132. <http://www.ncbi.nlm.nih.gov/pubmed/11690115>

