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StuFoExpo2019

Student Research Expo 2019

Book of Abstracts

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Keynote Talk

Building a business from research: How we did it at DyNAbind and you can too

Dr. Michael Thompson
(Founder and CEO of DyNAbind GmbH)

DyNAbind
Hit Discovery and Validation

Abstracts

PanelSat® and PanelSat-Scout, paper and a mock-up-model

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PanelSat® is a satellite design, thought for Low Earth orbit purposes, which uses its panels for power harvesting and for fuel free attitude control and pointing. PanelSat-Scout inspired by the NASA NEA Scout project is a composition of Panel-Sat and an attached solar sail and mast/boom part similar to the NEA-Scout approach, which would allow the spacecraft to obtain low earth orbit (LEO) escape with solar sail propulsion.

Both spacecraft are using center of solar radiation pressure (cp) and center of mass (cm) displacement but also ct (center of thrust) displacement as preferred means for steering and pointing.

Special features are the possibility, to launch large already fully mounted solar cell arrays without the need to deploy them in space and the combination of different actor modules in addition to the panel actors on each of the spacecraft axles.

To demonstrate the overall appearance of the design in real, a mock-up model of the spacecraft has been built for ISSS2019 in Aachen Germany.

Safety Assessment of Future Mobility using MOBATSim

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Automated driving systems tend to be more prominent and sophisticated in the nearest future. The functional safety assessment for these systems becomes an urgent necessity for the transition to full autonomy. Testing these functions consisting of decision and control algorithms, in a unified manner, is a challenging task. This task requires the analysis of complex operational profiles; such as routing, intersection management, and collision prediction, in an environment where multiple vehicles emerge from different positions, traveling at different speeds. There is a need for a comprehensive traffic simulation framework, which does not only model the functionality of the vehicles but also the interactions between them.

As a solution, we offer a new simulation framework, MOBATSim, which is a simulation framework based on MATLAB Simulink that allows the user to assess vehicle level and traffic level safety by a 3D traffic simulation. It allows the user to customize the decision and control algorithms for the modelled autonomous vehicles and to analyze their effects on the overall safety of the high-level urban traffic environment. The user can define safety goals, derive functional safety requirements, describe driving scenarios, and verify if the designed systems meet the requirements. The simulation-based fault injection is used to perform the tests in the presence of various types of random or predetermined faults of low-level vehicle components such as sensors and communication modules. The data can be logged during the simulations and later be used by Simulink 3D Animation for visual investigations.

Increasing Public's Value-Action on Climate Change: Integrating Intelligence Analytics to Edge Devices in Industry 4.0

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Rapid growth of Big Data and Internet of Things (IoT) provides promising potentials to the advancements of methods and applications in increasing public awareness on climate change. The fundamental principle behind this method is to provide quantifiable calculation approach on several major factors that affect climate change, where one of the most well known factors is the Greenhouse Gases (GHG) with CO2, methane, and nitrous oxide as major contributors. By utilizing Big Data and IoT, an approximate release of GHG can be calculated and embedded inside common household devices such as thermostats, water/heat/electricity/gas meter. An example is the CO2 released by a cubic of water. By using reverse calculation, an approximate CO2 release can be sequentially retrieved as follows: (1) water meter measures consumption, (2) calculate hp and kWh of pump used to supply one m3 of water, (3) calculate the amount of fossil fuel needed to produce one kWh, and (4) calculate CO2 released to the atmosphere from burning of fossil fuel per metric tons/barrel. Such analytical approaches are then embedded on household devices by providing updated information on GHG produced by hourly/daily/weekly/monthly energy usage, hence educating the public and increasing their awareness of climate change. This approach can be developed to provide an alarm of percentage of GHG released to the atmosphere by the excessive use of electricity/water/gas. Further actions in order to influence socio-economic function can later be established such as by establishing a rewards program by the government for people who can successfully manage their GHG emission.

Exploring Novel Neurogenic Transcription Factors in Human Induced Pluripotent Stem Cells

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1. Introduction

The possibility to reverse development in vitro by overexpressing four key transcription factors (TFs) to generate “induced” pluripotent stem cells (iPSCs) from fully differentiated cells was first demonstrated in 2006. Since then, interest in controlling iPS cell fate decisions by modulating the expression of TFs rapidly increased. In the present study, we aimed at validating novel neurogenic TFs in hiPSCs.

2. Methods

Candidate TFs were selected from an unbiased neuronal differentiation screening previously performed in the Busskamp Lab. In the screening, a collection of all human TFs was lentivirally delivered to a hiPSC line expressing a fluorescent reporter for posterior cell sorting by flow cytometry and sequencing. Neurogenin-1 (NEUROG1) + c-Myc associated factor X (MAX), NEUROG1 + SP100 nuclear antigen (SP100), Activating transcription factor 7 (ATF7), Homeobox B6 (HOXB6) and FOS like 2, AP-1 transcription subunit (FOSL2) were identified as novel neurogenic TFs. These combinations and individual candidate TFs, as well as NEUROG1 alone (positive control), were cloned into all-in-one plasmids upstream of a V5-tag and under the control of the tetracycline-response element. Subsequently, they were co-nucleofected with plasmids expressing the piggyBac transposase into PGP1 human iPSCs. The generated cell lines were posteriorly characterized transcriptionally and phenotypically.

3. Results

We confirmed that NEUROG1 alone and in combination with MAX and SP100 drives neurogenesis in PGP1 cells, whereas HOXB6 promotes the differentiation of hiPSCs towards a so-far undefined cell type with expression of neuronal markers.

Ölbinder aus nachwachsenden Rohstoffen für die Havariebekämpfung auf dem Meer und im Iran

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Im Rahmen des Verbundprojektes „BioBind“ (http://biobind.de/) sowie einem Folgeprojekt wurde ein Ölhavariebekämpfungssystem entwickelt, das eine schnelle Ölbeseitigung auch bei ungünstigen Wetterbedingungen und in Flachwassergebieten ermöglicht. Kern der Entwicklung bilden schwimmfähige holzfaserbasierte Ölbinder, die per Flugzeug oder Schiff ausgebracht und mit Netzsperren oder im Brandungsbereich der Küste wieder aufgenommen werden können. Dieses Havariesystem wird im Rahmen eines EU-Projektes im Südbaltischen Gebiet etabliert (https://southbaltic.eu).

Seit 2017 bestehen enge Kontakte zu Forschungs- und Industriepartnern im Iran. Ziel der Kooperation ist der Transfer der BioBind-Technologie in die Region des Persischen Golfes. Dabei sollen die Ölbindermaterialien unter Einsatz regional verfügbarer landwirtschaftlicher Reststoffe und lokaler Anlagentechnik produziert werden.

Im Rahmen meines Forschungspraktikums habe ich vier Monate an der Universität Teheran gearbeitet und war auch in verschiedenen Landesteilen unterwegs. Zu meinen Aufgaben gehörte die Recherche zur aktuellen Lage der holzverarbeiteten Industrie im Iran und der verfügbaren Rohstoffe und Technologien. Im Iran sind hauptsächlich Reststoffe der Landwirtschaft (z.B. Bagasse), Laubhölzer und Schnittreste von Plantagen verfügbar. Es gibt einige Spanplatten- und MDF-Hersteller. In Versuchen habe ich die Ölbinder aus Pappelholz, Stroh und Bagasse hergestellt und ihre Schwimmfähigkeit, Ölaufnahmekapazität und die Festigkeitseigenschaften untersucht. Es gelang im Labormaßstab vergleichbare Eigenschaften zu den Referenzmaterialien zu erzielen.

The erosion behaviour of pure tungsten electrodes in Gas Tungsten Arc Welding (GTAW)

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A cross-time study has been made on the erosion behaviour of Gas-Tungsten Arc Welding (GTAW) for pure tungsten electrode.
Its behaviour during arcing was analysed and compared from the points of view of metallurgical changes in electrode due to long-term operation. Metallographic studies of the electrodes indicate that the crack formation and grain growth
during periodic temperature variations. These observations are discussed theoretically based on the experimental results and the thermal expansion parameters of Tungsten.

CFD Simulation of Electrocoagulation Process for Optimisation of Gas Bubble and Water Flow

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2 million tons of industrial and agricultural wastes are drained every day. Around 70% of industrial sewages are directly discharged into water sources without any treatment in developing countries. Although wastewater treatments usually require chemical supply, electrocoagulation (EC) works with only electric power. This study project investigates the EC-reactor with spiral electrodes designed by Grundfos. Hydrogen gas bubbles are produced and accumulated inside the electrolytic cell, which they cause electrical resistance increase and efficiency reduction. The EC operates with different flow rates (Q=1-1000 l/h) through two batches of the watering stage (Case 1-3) and the degassing stage (Case 4-6) sequentially. Two-phase flow interactions between water liquid and hydrogen gas are modelled via computational fluid dynamics (CFD). For CFD-simulation of the EC-process, the fluid volume was firstly extracted from computer-aided design (CAD). Besides, CAD-files were complex, and they were simplified by removing small features. Secondly, the fluid domain was discretised via ANSYS Meshing, and it generated 2 million tetrahedral meshes. Thirdly, the solver settings were set in ANSYS CFX with Euler-Euler approach and turbulence model of shear stress transport (SST). The hydrodynamic equations of continuity and momentum were iteratively solved via high-performance computing (HPC) with two Linux clusters. The simulations consist of 6 cases with different. The results showed flow characteristics such as sufficient resistance time, water circulation by velocity vectors, gas penetration into the water inlet channel, gas holdup while watering and degassing, and finally the optimal period for the degasification.

Diagnose im Dialog – Zur Bedeutung von Diagnosen in der systemischen Therapie

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In der systemischen Therapie besteht weitestgehend eine kritische Haltung gegenüber Diagnosen. Aufgrund der Ende 2018 erfolgten sozialrechtlichen Anerkennung der systemischen Therapie als Kassenleistung und der damit verbundenen Verpflichtung zur Diagnosevergabe werden Diagnosen derzeit besonders kontrovers diskutiert. Vor diesem Hintergrund untersucht die vorliegende Arbeit auf verschiedenen Systemebenen die Bedeutungen und Wirkungen, die Diagnosen in der systemischen Therapie zukommen können. Dabei werden u.a. die Perspektive des Klienten, des Therapeuten und der Gesellschaft betrachtet, immer verbunden mit der Frage, welche Bedeutungen und Wirkungen Diagnosen für die jeweiligen Akteure erhalten und entfalten können.

Die empirische Basis der Untersuchung bilden Experteninterviews mit systemischen Therapeutinnen, die mithilfe der qualitativen Inhaltsanalyse ausgewertet werden. Ziel ist, anhand der getroffenen Aussagen verschiedene Bedeutungs- und Wirkungszuschreibungen von Diagnosen zu identifizieren, daraus die Haltung gegenüber Diagnosen abzuleiten und diese auf den systemischen Diagnose-Diskurs zu beziehen.

In den Ergebnissen zeigen sich Gemeinsamkeiten in den vielfältigen beobachteten Bedeutungs- und Wirkungszuschreibungen von Diagnosen, sowie Unterschiede in der geübten Diagnosekritik und der erachteten Vereinbarkeit von systemischer Therapie und Diagnosevergabe. Zudem wird auf der Systemebene „Therapeut“ deutlich, dass die interviewten Therapeutinnen die Verpflichtung zur Diagnosevergabe als unterschiedlich belastend empfinden. Dabei gibt es Hinweise darauf, dass eine höhere Kongruenz zwischen der Ausprägung empfundener Diagnosekritik und der tatsächlich praktizierten Diagnosekritik ein geringeres Belastungsempfinden zu evozieren scheint.

Die Innensicht systemischer Therapeutinnen im Umgang mit Diagnosen, aber auch die identifizierten Bedeutungs- und Wirkungszuschreibungen auf den anderen Systemebenen zeigen ein über die systemische Therapie hinausgehendes hochrelevantes Themenfeld auf, das zukünftig in der Psychotherapieforschung weiter untersucht werden sollte.

Bearbeitung der Gattung Frullania für die Flora von Kuba

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In dieser Studie wurden 133 Belege der Lebermoos-Gattung Frullania (Frullaniaceae, Marchantiophyta) aus dem Herbarium Hausknecht (JE), gesammelt in Kuba vor allem zwischen den Jahren 1968 und 1972 von den DDR-Botanikern J. Bisse & H. Lippold, R. Schubert und E. Köhler, bearbeitet. Davon konnten 81 Belege bestimmt werden. Fünf gemäß ihren Untergattungen festgelegte Kladen (*F.* subg. *Meteoriopsis* sect. *Intumescentes*, *F.* subg. *Meteoriopsis* sect. *Obtusilobae*, *F.* subg. *Diastaloba*, *F.* subg. *Chonanthelia* und *F.* subg. *Frullania*) und 13 Arten (*F. atrata*, *F. brasiliensis*, *F. caulisequa*, *F. cobrensis*, *F. donnellii*, *F. ericoides*, *F. exilis*, *F. gibbosa*, *F. intumescens*, *F. kunzei*, *F. moritziana, F. riojaneirensis*, *F. taxodiocola*) wurden bestimmt. Neufunde für die Insel sind *F. donnelllii*, *F. exilis*, *F. moritziana* und *F. taxodiocola*. Dies erhöht den aktuellen Kenntnisstand der kubanischen *Frullania*-Flora auf 30 Taxa. Angegeben werden Untergattungs- und Artbestimmungsschlüssel, eine Beschreibung der Verbreitung und der relevantesten morphologischen Merkmale der Taxa sowie Abbildungen zur Darstellung der Arten.

Understanding the Process of Retinal Lamination - The Role of Actomyosin on Photoreceptor Translocation

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The correct positioning of distinct cell types within the finally layered retinal structure is crucial for the formation of a functional retina. To allow precise layering, neurons need to actively move to the right position in the retina. One important step of retinal lamination is the formation of the outer photoreceptor layer. The correct positioning of photoreceptors is important for the first step of light transduction, the collection of photons from the environment. In biology it is well known, that the cytoskeleton (e.g. microtubules and actin) contributes in many ways to the movement of cells. Therefore, we focused on the contribution of actin and the actin associated motor protein myosin to the bidirectional migration of cone photoreceptor cells in the developing zebrafish retina. We used an advanced imaging method called light sheet microscopy, which allows us to trace and visualize the development of the retina in a living sample over a long period of time. We show that actin distribution is dynamic during whole process of bidirectional movement and actin rearrangements are not restricted to a certain direction of translocation. In contrast, myosin accumulations only emerge during translocation towards their final outer position and below the nucleus of photoreceptors, suggesting that actomyosin-mediated contractility might play a role in the switch of direction. Furthermore, we demonstrate the importance of branching of actin filaments for translocation in both directions, as inhibition of filament branching resulted in impaired translocation of photoreceptors. Overall, our results suggest that the molecular mechanisms driving photoreceptor translocation may vary depending on the direction of movement and point out the underlying dynamics of cytoskeletal components in a migrating cell during retinal development.

Theory and simulation on nonlinear spin-wave dynamics in magnetic vortices

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Nature is full of nonlinear phenomena in which the change of a given system is not directly proportional to its current state. Important examples can be found e.g. in fluid dynamics, weather and climate, social dynamics or neuronal systems. Although the behavior of such systems can be very difficult to predict they show interesting characteristics - such as solitons, multi-stability, wave turbulence or chaos - all of which are not present in linear systems. Nowadays, there is more and more interest in utilizing nonlinear systems for technical applications. For example, artificial neuronal networks harness nonlinear dynamics on a software level. The aim of this project is to investigate a nonlinear system which could provide a way for a hardware implementation of nonlinear networks on the micrometer scale.

In a ferromagnet, the elementary magnetic moments are aligned parallel to each other. When moved out of their static direction, the magnetic moments perform a spinning motion around it like a spinning top. This motion can propagate as a wave through the magnet, called spin wave. These spin waves are coupled to each other and behave nonlinear. For example, one wave can decay into other waves in well defined channels. The aim of this project is to provide an analysis of the nonlinear spin-wave dynamics in a micrometer-sized ferromagnetic disk magnetized in the vortex state, using micromagnetic simulations as well as theoretical methods.

Mörder, Blutvergießer, Antichrist. Das Antichrist-Narrativ in der konfessionellen Polemik des 16. Jahrhunderts.

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Eine Untersuchung anhand der Flugschriftenkontroverse um die Heiligenerhebung Bennos von Meißen.

Die sprachliche Herabsetzung des konfessionellen Gegners bildete ein zentrales Mittel in den Glaubenskämpfen des 16. Jahrhunderts. Besonders Martin Luther nutzte in diesem Kontext die fundamentale Stigmatisierung der katholischen Kirche zum Antichrist als rhetorische Waffe. Doch auch altgläubige Theologen wie Hieronymus Emser, Paulus Amnicola und Augustin von Alveldt greifen diesen schwerwiegenden Vorwurf auf und wenden ihn ihrerseits gegen Luther.

Ich habe mich mit vier Flugschriften aus der ersten Hälfte des 16. Jahrhunderts auseinandergesetzt, deren thematischer Schwerpunkt die Heiligenerhebung Bennos von Meißen ist und die Antichrist-Polemik in ihrem funktionalen und kontextuellen Zusammenhang betrachtet. Alle analysierten Schriften verhandeln mit der Heiligenerhebung ein elementares christliches Themengebiet mit unmittelbarem Einfluss auf die Frömmigkeitspraxis, sodass es von essentieller Bedeutung war die Deutungshoheit darüber an sich zu ziehen. Der Antichrist als zentrale Figur der mittelalterlichen Theologie und Frömmigkeit eignet sich dabei als „Waffe“ in dieser Fundamentalauseinandersetzung, was ich anhand der Funktionsbestimmung dieses Narratives in den vier Flugschriften belege. Der eschatologische Kontext, in den das Erscheinen des Antichrist stets eingebunden ist, ermöglicht dabei eine starke Emotionalisierung der Rezipienten und macht es für diese unmöglich, indifferent zu bleiben, sodass eine entsprechende religiöse Gruppenbildung unausweichlich erscheint.

Meine Analyse ist dabei durch das Konzept der Invektivität fundiert, welches im Rahmen des Sonderforschungsbereiches 1285 entwickelt wurde. Damit vermag ich es zu zeigen, dass die Herabsetzung des konfessionellen Gegners keineswegs eine emotionale Entgleisung ist, sondern vielmehr von zentraler Bedeutung für die konfessionellen Kontroversen des 16. Jahrhundert

Program for 6th of November
Student Research Expo 2019

5:00 pm Welcome, Keynote Talk by Michael Thompson
6:00 pm 90-Seconds-Pitches: Poster Presentations
7:00 pm Get Together! Poster Session with Snacks
8:00 pm Award Ceremony & Open End

Exhibition of the posters

7 November from until 15th November 2019:
Andreas-Schubert-Bau (ASB), foyer (first floor)
18 November until 25th November 2019:
Hörsaalzentrum (HSZ), foyer (ground floor)

More information you will find online:
https://stura.link/stufoexpo2019