Sandeep Kumar Singh

CONTACT DETAILS & INFO

Address	202-OG-119, Kalkhorstweg 54, PLZ-17235, Neustrelitz, Germany
E-Mail	sandeep.singh@dlr.de, sandeep.tubs@yahoo.com
Phone	+49-3981-480-110
Website	https://sandeepksingh.com
Github	https://github.com/sansastra

WORK EXPERIENCE

Research Scientist
2019-present

German Aerospace Center (DLR), IKN, Neustrelitz, Germany

- Research: Developing an anomaly detection software in Python for traffic situation assessment, control and navigation of maritime vessels. Developing hybrid learning solution for vehicle tracking using machine learning and Kalman filtering.
- Projects: IntelliMar & EMS III. In these projects, we try to improve the integration of various data sources and services into a networked system for the detection and management of maritime security scenarios. My role in the projects is to scientifically investigate whether machine learning techniques are useful in detecting anomalies using Automatic Identification System (AIS) data, and develop artificial intelligence methods for the use in maritime traffic situation determination and assessment.

Research Staff & PhD Student
2014-2019

Technical University of Braunschweig, Germany

- Research: Designed high bit-rate fiber (SDM) optical networks with least spectrum fragmentation. Developed analytical models and algorithms for optical resource allocation. Applied machine learning for allocating resources under time-varying traffic scenario, detecting power jamming attacks, and reducing energy consumption in fiber-wireless networks.
- Teaching: Broadband Communication (Optical transceiver and network components, OTN, WDM), Advance Topics in Telecommunication, Network Lab (OSPF, TCP/IP, BGP)
- Projects: Writing and conceptualizing of European Union*, DFG**, and industrial projects.
  *EU project: mF2C- Fog-to-Cloud Management Ecosystem, www.mf2c-project.eu
  **DFG project: Metrology for THz Communications (Link)
  Partially worked for a DFG project: New Horizons in Optical Networking (see publications)
  Partially worked on an "Animal Welfare" project, leading to a publication (Link)
- Supervision: Three Master's theses in optical networks, fiber-wireless networks, and IoT

Teaching Assistant
2012-2013

Indian Institute of Technology Madras, India

- Optical networks, and Digital design lab

Visiting Student
2011-2012

Technical University of Berlin, Germany

- Project objective: designing an algo. for reducing packet collision in a virtual optical network

Internship 2009-2010

Defense Research and Development Organization (DRDO), Bangalore, India

- Project objective: achieving high-speed serial communication over PCI express protocol

EDUCATION

PhD in Computer and Network Engineering 2014-2019

Technical University (TU) of Braunschweig, Germany

- Thesis title: "Stochastic Analysis and Learning-based Algorithms for Resource Provisioning in Optical Networks" [available online] **[Grade: Summa Cum Laude, highest]**
- PhD Advisor: Prof. Admela Jukan, TU Braunschweig, Germany
  Committee: Prof. Vincent Chan, MIT, USA; Prof. Krishna Sivalingam, IIT Madras, India
- Abstract: The thesis deals with the resource management tasks in fiber and wireless networks through theoretical modeling and learning-based algorithms. It presents an exact Markov model for Routing and Spectrum Allocation (RSA) schemes, and subsequently provides approximate models for the modeling of RSA in large scale networks. Furthermore, the thesis presents efficient resource (re)allocation schemes, and utilizes machine learning techniques for handling resources and traffic in optical datacenter networks, and managing bandwidth and energy consumption in network and edge devices in fiber-wireless networks.

Master of Science (M. S.) in Electrical Engineering 2010-2014

Indian Institute of Technology (IIT) Madras, India

- Thesis title: "Virtual Optical Bus: A New Paradigm for Optical Transport Networks" [**Grade: 8.9/10**]
- M. S. Advisor: Dr. R. Manivasakan, IIT Madras, India
- Abstract: The thesis presents heuristic solutions to optimize virtual connections or lightpaths with the objective of minimizing packet collision in optical burst-switched networks. To this end, flows are grouped together into a set of virtual optical buses (VOBs), and a co-ordination is established among flows so that intra-VOB packet collision is completely suppressed and inter-VOB packet collision is minimized.

Bachelor of Technology (B. Tech.) in Electronics and Communication Engineering 2006-2010

SASTRA University, Thanjavur, India

- Thesis title: "High-Speed Serial Communication with FPGA" [**Grade: 8.35/10**]
- Abstract: The thesis implements an interface in the VHDL language for a high speed serial data transmission (2.5 Gb/s and 5 Gb/s) with a PCI Express protocol through a transceiver block of FPGA. The data was processed further for different applications (This work was supported by a SUKHOI-30 project at DRDO, Bangalore, India).

SKILLS

Languages	Hindi (fluent), English (fluent), German (Intermediate)
Software	C, Java, Python, Matlab, VHDL, Optisystem, OMNET++, Machine learning frameworks and libraries (TensorFlow, Keras, Scikit-Learn, Numpy, Pandas), Git-hub, IBM Studios
Hardware	Analog and digital circuit design, Internet-of-Things (R-Pi)
Analytical	Markov & probabilistic modeling, Optimization, Bayesian filtering

PUBLICATIONS

All publications: https://scholar.google.com/citations?user=Xv2O8dgAAAAJ&hl=en
Major Publications:

- **S. K. Singh** and A. Jukan, "Computing Blocking Probabilities in Elastic Optical Networks with Spectrum Defragmentation," in proc. of *IEEE Conference on Computer Communications (INFOCOM)*, Paris, April 2019.
- **S. K. Singh**, F. Carpio, and A. Jukan, "Improving Animal-Human Cohabitation with Machine Learning in Fiber-Wireless Networks," *MDPI Journal of Sensor and Actuator Networks*, vol. 7, no. 3, 2018.
- **S. K. Singh** and A. Jukan, "Machine Learning-based Prediction for Resource (Re)allocation in Optical Data Center Networks," *IEEE/OSA Journal of Optical Communications and Networking (JOCN)*, vol. 10, issue 10, pp. D12-D28, 2018.
- **S. K. Singh** and A. Jukan, "Efficient Spectrum Defragmentation with Holding Time Awareness in EONs," *IEEE/OSA JOCN*, vol. 9, no. 3, pp. B78-B89, 2017.

AWARDS, ACHIEVEMENTS AND SERVICES

IEEE Member, Reviewer for IEEE Trans. on Networking; IEEE/OSA J. of Optical Comm. & Netw.; IEEE Comm. conferences 2016-present

Invited Talks 2019-20
Resource Allocation in Optical Networks, IIT Indore, India
Application of Machine Learning in Communication Networks, VIT, India

Attended Subsea fiber optical communication schools by Google 2019, 20

Attended a cloud and edge computing workshop by SixSq, Switzerland 2018

Outstanding Paper Award 2016
S. K. Singh, W. Bziuk and A. Jukan, "Balancing Security and Blocking Performance with Reconfiguration of the Elastic Optical Spectrum," MIPRO*, Croatia, 2016.*

Recipient of DAAD Scholarship, Germany 2011-2012

Graduate Aptitude Test in Engineering rank 835 (99.5 percentile) 2010

Won robotics prizes and Science quizzes; Designed electronic circuits for displaying images and a cartoon on an oscilloscope 2007-2009

REFERENCES

Prof. Admela Jukan
TU Braunschweig, Germany
Phone: +49-531-391-3735
Email: a.jukan@tu-bs.de

Dr. Frank Heymann
German Aerospace Center, Germany
Phone: +49-3981-480-217
Email: frank.heymann@dlr.de