Spatial Networking in the United Physical, Virtual, and Mental World

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Abstract

We are witnessing the rapidly growing popularity and activity in the use of networking models and solutions for solving problems in many specific areas. As a universal approach, networking can be also used for solving complex problems simultaneously covering very different domains. The main goal of this book is to investigate and propose universal networking techniques and solutions that could simultaneously cover different areas for finding united solutions, using for this patented and revealed in previous books and publications Spatial Grasp Model and Technology (SGT). The book will review, analyze, and classify the current use of networks in many physical, virtual, and mental areas, psychological and psychiatric including. It will provide a brief summary on SGT and its main features, details of Spatial Grasp Language (SGL) and its networked implementation, which can operate without any central resources and cover arbitrary large areas. Then will describe fundamental network operations under SGT which can be performed in parallel and fully distributed mode, also propose efficient solutions for one of the most important features of graphs and networks called Centrality and its different variants in SGL. It will show examples of unique high level networking solutions in the combined worlds obtained by the results of this book, also propose spatial solutions with active networking patterns, in both pattern matching and recognition mode, representing SGL as a real pattern language. The book will also include a special chapter on the latest works using SGT for modeling organoids and organoid cultures, which are extremely important in medicine and brain research. The book's results confirm efficiency of SGT in development of networking methods for solving complex problems in combined distributed systems. The investigated network processing paradigm, traditionally having simple implementation, allows us to directly operate in physical, virtual and mental spaces in a clear and compact mode, radically differing from traditional algorithmic thinking and methods. Refs: "Spatial Grasp" in www.google.com, Research Gate: https://www.researchgate.net/scientific-contributions/Peter-Simon-Sapaty-70005622

Chapter 1: Introduction

There is rapidly growing popularity of the use of networking models and solutions for solving problems in specific areas. As a universal approach, networking can be potentially used in a much broader sense, for solving complex problems simultaneously covering physical, virtual, and mental (psychological) domains. The main goal of this book is to investigate and propose extended networking techniques that could simultaneously cover different areas for important united solutions, using the patented and revealed in previous books and publications Spatial Grasp Model and Technology. The chapter will include a brief summary on the following chapters together with references on existing publications in the similar fields.

Chapter2: The Use of Networks in Physical, Virtual, and Mental Domains

It reviews, analyzes, and classifies existing publications on the use of networks in different areas, like traffic networks, battle networks, economic networks, virtual networks, and psychological networks, where the latter have emerged as a very popular method for studying mental deceases. For example, psychopathology networks consist of symptoms of mental disorders (nodes) and the connections between those aspects (edges). Works on network centrality issues for finding most important nodes that can influence behavior and value of the whole network are investigated too, covering centrality in social networks, centrality transport and underground networks, and centrality in psychological networks.

Chapter 3: Spatial Grasp Technology (Sgt) and its Main Features

Having more than half-century history and experience of distributed computer networking, this recursive super-virus model and technology, which is self-evolving, self-migrating, and self-matching in distributed environments (as symbolically in Fig. 1), will be briefed and explained, including its used applications in different areas and countries. It can dynamically establish and keep superior vision and power over any centralized and distributed systems, at the same time being fully independent of their organizations and networked structures, but

rather creating, supervising and modifying them if needed.

Fig. 1. Parallel wavelike world coverage with Spatial Grasp Model.

Chapter 4: Spatial Grasp Language (SGL)

It provides complete Spatial Grasp Language details which may be particularly useful for proper understanding of practical examples in the subsequent chapters. The chapter describes different types of SGL constants and variables with their semantics, spatial distribution and movement, also provides full repertoire of SGL rules with their semantics and practical use, which include type, usage, movement, creation, echoing, verification, assignment, advancement, branching, transference, exchange, timing, qualification, and grasping. Elementary examples of programming in SGL are provided too, along with its full syntax and mostly used constructs.

Chapter 5: Networked Sgl Implementation

Explains how SGT can be implemented with communicating SGL interpreter copies potentially numbering millions to billions, which can be easily embedded into any existing systems, Internet including, representing altogether powerful spatial engines capable of solving any problems in terrestrial and celestial environments. As both backbone and nerve system of the distributed interpreter, its self-optimizing Spatial Track System supports hierarchical command and control as well as remote data and code access. It also supervises spatial variables and merges distributed control states used for decisions at higher organizational levels. Distributed SGL interpretation networks can effectively operate without any central control.

Chapter 6: Basic Network Operations in Different Worlds Under Sgt

It presents detailed solutions for network creation, network modification, network recovery, finding different paths, shortest path trees and shortest paths, cliques, articulation points, etc., also proper graph images. Shows how to support network integrity, provide the global network awareness, collect network statistics, also find and collect proper network parts and create similar ones in other spaces. The investigated networks can be physical, virtual of combined, having both addresses and physical coordinates, also hierarchical. Links may have any weights, and both links and nodes may have any additional contents. The created networks can be active, can exist as autonomous systems self-evolving is space. All presented network solutions are fully distributed and parallel, with networks potentially covering any terrestrial and celestial areas.

Chapter 7: Expressing and Solving Network Centrality Solutions in Sgl

It investigates, evaluates, and models one of the most important features of graphs and networks called Centrality, with its variants Degree Centrality, Closeness Centrality, Betweenness Centrality, and Eigen Vector Centrality. Detailed, very efficient and extremely compact SGL scenarios for solving these centrality problems on the chosen network topology are provided and discussed, being highly parallel and fully distributed. They can operate on arbitrary complex and large networks, which can evolve in time and space and cover the whole countries or even the universe, and without any centralized resources, taking into account the practical availability of networked SGT implementation in any distributed environments.

Chapter 8: Examples of Holistic Networking Solutions in the Combined Worlds

Practical cases will be investigated with integration of different types of networks into a super-network operating as an integral whole under SGT and capable of providing solutions unachievable by separate networks or their mere collection. This will include: (1) Physical network, reflecting transport, economic, or/and military networks; (2) Virtual network, representing distributed and interlinked information, which may have common nodes with 1; (3) Social network, matching organization of a society, may have common nodes with 1, 2; (4) Mental, psychological or psychiatric network, revealing moral problems, feelings and opinions, with nodes and links in brains of individuals or between them, also as noticed and fixed symptoms of their behavior (may intersect with 1, 2, 3).

Chapter 9: Active Spatial Patterns in Sgl Versus Traditional Algorithms

Pattern is everything around us; it can represent world's regularity, human-made design, a model, plan or diagram, standard way of modeling, acting and thinking, a distinctive style or form, a combination of qualities and tendencies, etc. The chapter will investigate how SGL can create active networking patterns for solving diverse problems, with practical solutions for spatial pattern recognition and pattern matching in distributed networks. SGT, based on pattern-like scenarios can be considered as a contribution to patterns theory, and SGL as a real pattern language. This spatial pattern style radically differs, both mentally and mathematically, from traditional meanings of algorithm as a finite sequence of instructions for solving specific

problems or performing computation.

Chapter 10: Spatial Networks as Models for Organoid Cultures and Brain Research

This is a special chapter describing the use of the developed spatial grasp paradigm for creating and supporting dynamic, active, self-growing and self-modifying spatial networks effectively modeling organoids and organoid cultures, which are extremely important in medicine, fighting diseases, and brain research. It first analyses and classifies many organoid-related publications and then shows practical contributions of the book in this area, which can be used in vitro-style mode but with reduction of complex and lengthy physical experiments.

Chapter 11: Conclusions

The results of this book confirm efficiency of SGT in development of networking methods for solving complex problems within combined distributed systems. The paradigm allows us directly move and operate in physical, virtual and mental spaces by clear and compact mode, radically differing from traditional algorithmic thinking. It symbolically creates holistic networking "creatures" which are self-evolving, self- propagating, and self-matching the distributed worlds. The latest version of SGL can be implemented by a group of system programmers, even in university environments, as was done for the previous versions in different countries. Future plans of this work include application of SGT and SGL for extended network- based systems, in psychology and psychiatry including.

References

Contain information on many publications describing the use of networking models and approaches in different areas which are analyzed and classified in the book chapters, also published basic sources on the SGT and SGL.

Other Books Analyzed, Compared, and Used for This Book Project

The following books were investigated in detail on how they may relate to the current book proposal. The results of this analysis confirm that the proposed advanced networking methods and their supporting technology of the current book, especially allowing for holistic integration of physical, virtual, and psychological domains, can be useful for solving the mentioned and extended problems practically for every book referenced.

1. D L S Wright (2022) The Physical and Virtual Space of the Consulting Room: Room-object Spaces, Routledge $157. -- Examines the role of space and objects in the psychoanalytic process, explores spatialisation as simultaneously being a psychological projection of meaning and physically acting upon environment.

2. P L Weiss, E A Keshner (2014) Virtual Reality for Physical and Motor Rehabilitation (Virtual Reality Technologies for Health and Clinical Applications), Springer, $130. -- Reviews two decades of progress in virtual reality for physical and motor rehabilitation, offers research on the capacity of VR to evaluate, address, and reduce motor skill limitations.

3. P Friedman (1984) The Pilates Method of Physical and Mental Conditioning, Doubleday, $470. -- A unique system of physical and mental exercise, which stresses control and centering of the body, precise movement, smoothness of motion, proper breathing, and relaxation.

4. B Wixted (2009) Innovation System Frontiers: Cluster Networks and Global Value (Advances in Spatial Science), Springer $121. -- Using interdependencies between key economies analyses systems that cross national borders, shows that technological complexity is an important factor in the formation of production networks.

5. R L A Mors ink (1999) Foreign Direct Investment and Corporate Networking: A Framework for Spatial Analysis of Investment Conditions, Edward Elgar Publishing, $142. -- Examines foreign direct investment from spatial perspective and considers how knowledge, regional synergies, economic integration, corporate strategies and networking affect patterns of investment.

6. L. Bai, X Liang (2020) Spatial Multidimensional Cooperative Transmission Theories and Key Technologies, World Scientific, 2020, $158. -- Introduces theory and technologies of multi-antenna system, describes spatial multi-dimensional cooperative transmission in the ground-based, air-based and space- based communication systems.

7. K S Yang, S Shekhar (2017) Spatial Network Big Databases: Queries and Storage Methods, Springer.

8. $115. -- Provides a collection of concepts, algorithms, and techniques that effectively harness the power of spatial network big data, investigates scalable graph-based query processing strategies.

9. M Franke (2020) Managing Airline Networks: Design, Integration and Innovative Technologies (Managing Aviation Operations), Routledge, $116. -- Discusses the impact of network management on airline resource planning and performance, examines the interplay between network management and adjacent functions.

10. Qiuwei Wu, Feifan Shen, Zhaoxi Liu, Wenshu Jiao (2023) Optimal Operation of Active Distribution Networks: Congestion Management, Voltage Control and Service Restoration, Academic Press, 2023, $180. -- Provides case studies, modern implementations and supporting flowcharts and code, along with current research in congestion management, service restoration and voltage control of active distribution networks. ISBN-13 978-0443190155.

11. Adela Maria Isvoranu, Sacha Epskamp, Lourens Waldorp, Denny Borsboom (2022) Network Psychometrics with R: A Guide for Behavioral and Social Scientists, Routledge $149. -- Provides a comprehensive overview and guide to theoretical foundations of network psychometrics, infers network topology, estimates network parameters from different sources of data 260. eBook ISBN9781003111238

12. N. Meghanathan (2018) Centrality Metrics for Complex Network Analysis: Emerging Research and Opportunities (Advances in Wireless Technologies and Telecommunication), IGI Global $200. -- Research findings on centrality metrics and their broader applications for different categories of networks, including wireless sensor networks, curriculum networks, social networks, etc.

13. A. Lange (2019) Centrality in Strategic Transportation Network Design: An application to less-than-truckload networks (Edition KWV), Springer Gabler $50. -- Describes the appearance of a network by transportation network centrality, develops a strategic approach to transportation network design by conceptualizing transportation network centrality.

14. C Morselli (2013) Crime and Networks (Criminology and Justice Studies), Routledge, 2$227. -- Showcases the use of social networks in the analysis and understanding of various forms of crime, applies to criminology many conceptual and methodological options from social network analysis 360.

15. J. Read, R. Bentall (2013) Models of Madness: Psychological, Social and Biological Approaches to Psychosis (The International Society for Psychological and Social Approaches to Psychosis Book Series), Routledge $205. -- Challenges beliefs that madness can be explained without reference to social causes, updates the research showing that hallucinations, delusions etc. are best understood as reactions to adverse life events.

16. V A Diwadkar, S B Eickhoff (2021) Brain Network Dysfunction in Neuropsychiatric Illness: Methods, Applications, and Implications, Springer, 2021, $214. -- Provides a synthesis of the uses of multiple analytic methods applied to neuroimaging data, to seek understanding of the neurobiological bases of psychiatric illnesses pp. 1-15.

17. J Spence (2020) Human Pluripotent Stem Cell Derived Organoid Models (ISSN Book 159), Academic Press; 1st edition $186. -- Highlights recent and emerging advances that describe organoid differentiation protocols for the different organ systems that implement organoids as tools to understand complexity and maturation, high content drug screening, disease modeling, development and evolution.

18. J. Gopalakrishnan (2022) Brain Organoid Research (Neuromethods Book 189), Humana $155. -- Explores multiple methods and approaches used to generate human brain and neuroretinal organoids to address fundamental questions in human brain research.

19. M K Paul (2022) Organoid Bioengineering - Advances, Applications and Challenges (Biomedical Engineering), IntechOpen $126. -- Organoids are three-dimensional miniature tissue mimics established from embryonic stem cells, human pluripotent stem cells, adult stem cells, and cancer cells. These fascinating 3D organoids serve as a valuable tool for fundamental research, disease modeling, drug screening and discovery, regenerative medicine, and deciphering the mechanism of disease pathogenesis. ISBN: 978-1-80355-769-4

This Book is a Sequel to the Following Patent and Previous Books

20. P S Sapaty (1993) A distributed processing system, European Patent N 0389655 European Patent Office.

21. P S Sapaty (1999) Mobile Processing in Distributed and Open Environments. New York: John Wiley & Sons 410. ISBN:978-0-471-19572-6

22. P S Sapaty (2005) Ruling Distributed Dynamic Worlds. New York: John Wiley & Sons. doi:10.1002/0471656356

23. P S Sapaty (2017) Managing Distributed Dynamic Systems with Spatial Grasp Technology. Springer.

24. P S Sapaty (2018) Holistic Analysis and Management of Distributed Social Systems. Springer.

25. P S Sapaty (2019) Complexity in International Security: A Holistic Spatial Approach. Emerald Publishing.

26. P S Sapaty (2021) Symbiosis of Real and Simulated Worlds under Spatial Grasp Technology. Springer.

27. P S Sapaty (2022) Spatial Grasp as a Model for Space-based Control and Management Systems. CRC Press.

28. P S Sapaty (2023) The Spatial Grasp Model: Applications and Investigations of Distributed Dynamic Worlds. Emerald Publishing 184. ISBN:9781804555750

29. P S Sapaty (2024) Providing Integrity, Awareness, and Consciousness in Distributed Dynamic Systems, CRC Press.

The Latest Journal Papers Which Relate to This New Book

30. Sapaty PS (2023) Spatial management of air and missile defense operations. Mathematical Machines and Systems. N 1.

31. Sapaty PS (2023) Providing Distributed System Integrity under Spatial Grasp Technology, Mathematical Machines and Systems. N 2, https://www.emerald.com/insight/content/doi/10.1108/978-1-80455-574-320231001/full/html

- Sapaty PS (2023) Providing Global Awareness in Distributed Dynamic Systems, International Relations and Diplomacy 11: 87-100. doi: 10.17265/2328-2134/2023.02.002.
- Sapaty PS (2023) Simulating Distributed Consciousness with Spatial Grasp Model, Mathematical Machines and Systems. N 3.
- Sapaty P S (2023) Managing Distributed Systems with Spatial Grasp Patterns, Mathematical Machines and Systems. N 4.
- Sapaty P S (2023) Network Centrality Operations under Spatial Grasp Technology. Journal of Advances in Artificial Intelligence and Machine Learning 1: 1-11.
- Spatial Networks as Models for Organoid Cultures and Brain Research (2024) Mathematical Machines and Systems. N 1.