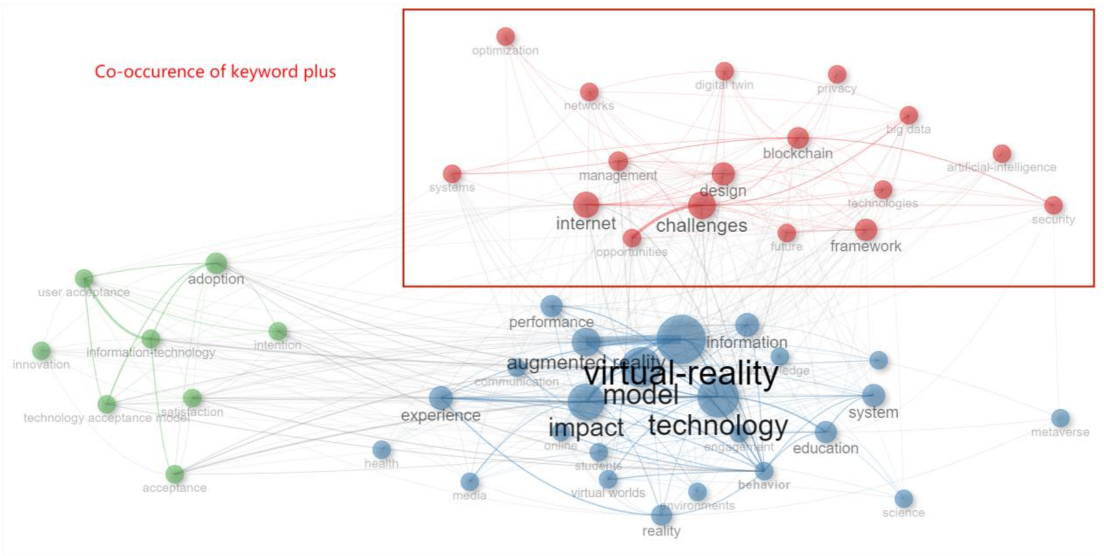
Project progress, questions and expected solutions

Progress:

Have a general understanding of Web 3.0. Narrowly speaking, before the prevailing age of block-chain, the main aspect of Web 3.0 is based on the semantic web service. With the development of technology, Web 3.0 has been given more content and expectation. Nowadays Web 3.0 aims to provide a more decentralized, secure and intelligence web experience, which means that block-chain and AI play more crucial roles. In this stage, I prefer to narrow the scope, combing one main-stream technology of Web 3.0 and a related broader topic. For example: *AI and semantic web, AI and decentralization technology, digital twin and meta-verse, semantic web and meta-verse, etc.*

Questions: How can I combine the analyzed topic with Web 3.0? For example, while I am conducting the study related to meta-verse, there is a clear co-occurrence cluster referring to techniques, including digital twin, block-chain, big data, artificial intelligence, etc. This is a breakthrough point which can be analyzed with Web 3.0. However, which kind of techniques should I take together?



Speculative Solutions:

(1) As we define Web 3.0 as the integrated web where machine will be able to understand and catalogue data in a manner similar to humans. The focus will be put on the machine's understanding ability and the semantic web will be the core. (narrow sense)

Key techniques: Resource Description Framework (RDF), SPARQL Protocol and RDF Query Language (SPARQL), Web Ontology Language (OWL), Linked Data, Semantic Web Services, etc.

(2) If we set Web 3.0 as a broader definition, that will cover decentralization, secure and intelligence. Decentralization means that Web 3.0 aims to distribute data and services across a network of nodes, reducing the control of any single entity and the core technology is block-chain. As for intelligence aspects, techniques like semantic web and AI will be focused on. (generalized sense)

Key techniques: mentioned above(1); block-chain - Cryptographic Hash Functions, Public

Key Cryptography, Consensus Mechanisms, Distributed Ledger Technology (DLT), Smart Contracts, Immutable Data Structures, Permissioned and Permissionless Blockchains, etc; AI - Machine Learning (ML), Neural Networks, Natural Language Processing (NLP), Computer Vision, Robotics, Expert Systems, Reinforcement Learning, Generative Models, etc.

(3) **Narrow research scope**

For example:

A. Semantic web and AI: these two concepts are based on different technologies, so can we identify the AI techniques applied in the field of semantic web?

B. Digital twin's applications in meta-verse

C. Applications of AI in decentralized data processing

D.

Related articles:

Combining Blockchain and Semantic Technologies: A Survey

Alsamani, A and Beckmann, A
IEEE 1st Global Emerging Technology Blockchain Forum - Blockchain and Beyond, (IGETblockchain)
2022 | 2022 IEEE 1ST GLOBAL EMERGING TECHNOLOGY BLOCKCHAIN FORUM: BLOCKCHAIN & BEYOND, IGETBLOCKCHAIN

Enriched Cited References

We survey literature that combines blockchain and semantic technologies. Our findings identify main areas where the combination of blockchain with semantic technologies are considered, and answer key research questions, surveying existing challenges addressed, their advantages, technical perspectives, and future recommendations.

Blockchain Intelligence: Intelligent Blockchains for Web 3.0 and Beyond

Li, JJ; Qin, R; (...); Wang, FY
Jan 2024 (Early Access) | IEEE TRANSACTIONS ON SYSTEMS MAN CYBERNETICS-SYSTEMS

Enriched Cited References

As the next-generation Internet characterized by readability, writability, and ownability, Web 3.0 necessitates the fusion of blockchain and artificial intelligence (AI) technologies to realize its vision of decentralization, user autonomy, and intelligent openness. To this end, this article proposes the integration of "AI for blockchain" and "blockchain for AI" to form a bidirectional enhancement loop, for establishing genuinely intelligent blockchains and ushering in a new paradigm referred to as blockchain intelligence. On this basis, the technical architecture of intelligent blockchains is proposed, which infuses intelligence into every layer of traditional blockchain architectures while enables the parallel execution between virtual and artificial intelligent blockchain systems. This architecture facilitates blockchain systems to cultivate an ecosystem of intelligence, extending from foundation intelligence to application intelligence. Moreover, the core attributes of blockchain intelligence are examined, from the perspectives of smart contracts, data, identity, and governance. Furthermore, the main challenges and research issues faced by blockchain intelligence are outlined. This article is committed to the advancement of blockchain intelligence, laying the groundwork for Web 3.0 and the impending era of smart societies.
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From metaverse experience to physical travel: the role of the digital twin in metaverse design

Deng, BL; Wong, IA and Lian, QL
Apr 2024 (Early Access) | TOURISM REVIEW

Purpose- Designing an effective metaverse experience through a tourism digital-twin platform is crucial to the success of metaverse tourism. How such a digital-twin platform should appeal to target users, however, lacks exploration. The study aims to advance a conceptual contribution by successfully creating a metaverse experience through a well-designed digital-twin platform. It also aims to show how the design science approach in tourism can enrich our understanding of digital-twin platform design elements introduced in metaverse experience design. Design/methodology/approach- Guided by the design science approach in tourism, this research conceptualizes the role of digital-twin elements in metaverse experience design and proposes a one-factor between-subject experimental design to examine the effect. Findings- This research conceptualizes how eight unique configurations of digital-twin design, which are embellished in two or three dimensions, shape tourists' metaverse experience and physical travel intention. Practical implications- The results offer operators clear strategic guidance on designing an effective tourism digital-twin platform. Originality/value- This study not only identifies the impact of digital-twin platform design elements but also clarifies how such elements affect customers' metaverse experiences.
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A brief study of Web 3.0 concepts and knowledge base

Definition

(1) Web 3.0 entails an integrated Web experience where the **machine** will be able to understand and catalogue data in a manner similar to humans. This will facilitate a world wide data warehouse where any format of data can be shared and understood by any device over any network. (R. Rudman & R. Bruwer, 2016[1])

(2) Web 3.0 is a next-generation web architecture that envisions a more **decentralised**, **secure** and **intelligent** Internet, which can be seen as a confluence of various technological advancements, including blockchain, artificial intelligence, semantic web and decentralised web technologies. (D. Kukreja & et al, 2023[2])

(3) Web 3.0 is an era of computing where the **critical computing** of applications is **verifiable**, which has two desirable properties: generic and measurable (ZT. Liu & et al, 2021[3]).

Knowledge base (Reference: scientometric review of Web 3.0)

(1) **Co-word - frequently used terms**

semantic web, linked data, edge computing, Internet, web, system, ontology, internet of things, management, big data, thing, machine learning, framework, cloud computing.

(2) **Clustering**

Keyword clustering - Common subjects

Defining supply chain management, Semantic representation, Industrial internet, Functional perspective, Edge computing, Geo-related data, Smart grid edge computing infrastructure, future challenge, Blockchain-enabled mobile edge computing system, Resource allocation, Social media, Managing big RDF data, Information technologies.

Cluster ID	Size	Silhouette	Mean year	Cluster label (LLR)
0	22	0.903	2013	Defining supply chain management
1	18	0.893	2014	Semantic representation
2	17	0.884	2018	Industrial internet
3	17	0.83	2014	Functional perspective
4	17	0.942	2014	Edge computing
5	15	1	2015	Geo-related data
6	15	1	2014	Smart grid edge computing infrastructure
7	13	0.847	2014	future challenge
8	11	0.861	2020	Blockchain-enabled mobile edge computing system
9	11	0.959	2019	Resource allocation
10	11	0.922	2012	Social media
11	9	0.978	2016	Managing big RDF data
12	5	0.979	2016	Information technologies

LLR: log-likelihood ratio; RDF: Resource Description Framework.

Co-citation clustering - Knowledge Foundation of Web 3.0

Cluster ID	Size	Silhouette	Mean year	Cluster label (LLR)	Representative document by
0	82	0.74	2006	Semantic web	D'Amato et al (2010)
1	74	0.807	2009	Sparql client	Rietveld and Hoekstra (2017)
2	73	0.952	2014	Edge computing	Yang et al. (2019)
3	67	0.795	2009	Visual query system	Soylu et al. (2018)
4	65	0.821	2008	Knowledge discovery	Dumontier et al. (2014)
5	65	0.977	2015	Deep reinforcement	He et al. (2021)
6	59	0.855	2010	Source selection	Sande et al. (2016)
7	53	0.855	2005	Virtual machine	Rodriguez (2011)
8	46	0.82	2007	Semantic web search engine	Hogan et al. (2011)
9	36	0.909	2006	Big RDF data	Ashraf et al. (2015)
10	29	0.933	2009	Processing scheme	Wylot et al. (2018)
11	28	0.919	2005	Geospatial semantic web	Becker and Bizer (2009)
12	27	0.959	2009	Geometric data	Pauwels et al. (2017)
14	21	0.987	2007	Socio-semantic integration	Dietze et al. (2013)
15	21	0.974	2008	Physical activity	Kolt et al. (2017)
16	15	0.977	2006	Intelligence analysis	Xu et al. (2016)
18	6	0.99	2007	Clinical guideline	Zamborlini et al. (2016)
19	6	0.969	2010	Geo-related data	Malik et al. (2018)

LLR: log-likelihood ratio; RDF: Resource Description Framework.

[1] *Defining Web 3.0: opportunities and challenges.* DOI: 10.1108/EL-08-2014-0140
[2] *Scientometric review of Web 3.0*. DOI: 10.1177/01655515231182073
[3] *Make Web3.0 Connected.* DOI: 10.1109/TDSC.2021.3079315