A Study on the Paths and Innovative Models for Laboratory Construction in the Discipline of Journalism and Communication

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Abstract: *In recent years, with the development of media technology, laboratories for journalism and communication have moved away from the old way of equipment replication and begun building computational media systems. The subject of this paper is the path Design for laboratory construction and the generation mechanism of innovative models, and the three dimensions of paradigm shift, technical architecture and evolutionary logic will be organized and studied here. First, with the iterative development of media technology, there has been a functional shift from teaching verification to knowledge creation, and the expansion of the path of capability dimensions in the environment of cross-media integration has led to changes in the logic of laboratory construction goals. Second, a heterogeneous integration scheme will be used to cooperate distribute computing and edge node resources; a perception-interaction hierarchical model for virtualised simulation environments will be introduced, and based on modular Design and intelligent embedding, a multimodal content processing engine with a technical architecture will be built. Finally, in light of the theory of niches, this paper examines how collaboration and symbiosis are created, and it can be seen that innovative models with agile response mechanisms and self-organising evolution rules in an open architecture are being developed systematically. Provide the theoretical basis and technical support for the construction of autonomous evolutionary capabilities of laboratories in the field of journalism and communication in this paper.*

Keywords: *Journalism and Communication Discipline Laboratory, Paradigm Shift, Modular Architecture, Intelligent Embedding, Innovation Model, Self-organizing Evolution*

Introduction

As the primary carrier of research and communication phenomenon simulation in media technology, the construction path and operating model of the Journalism and Communication Discipline Laboratory will directly affect the efficiency of updating the knowledge production method of the discipline. With the development of technology, algorithms for recommendations, content generation, extended reality, multimodal integration, etc., have shown that the traditional laboratory structure, which is mainly an analog broadcasting system and a linear editing station, has deficiencies in function and a slow response speed. If the laboratory continues to operate in accordance with the construction logic of historical industrial standards, it will not be able to meet the demand for new nonlinear variables and cross-media coordination of the communication system. Therefore, we need to promptly revise the function placement, technical structure and development path of the laboratory. This paper will systematically list the problems in this area and move away from the old way of listing equipment; instead, a new kind of flexible and self-organised laboratory will be proposed. Based on the direction of the paradigm shift, the construction logic of the modular intelligent technical architecture and the generation and evolution rules of innovative models are presented in this paper to help the Journalism and Communication Discipline Laboratory change from passive response to external technological changes to autonomous evolution based on internal niches.

1. Paradigm Shift and Functional Reconstruction of the Journalism and Communication Discipline Laboratory

1.1 The Displacement Logic of Laboratory Construction Goals under the Iteration of Media Technologies

With the development of media technology, it has moved from the old model of one-way linear communication to real-time interaction and intelligent distribution, and thus the construction goals of the journalism and communication discipline laboratory have also changed. The main contents of the traditional laboratory construction are analog radio and television broadcasting systems, linear editing workstations, basic photography equipment, etc.; the purpose is to achieve reproduction and operation training for the established communication process. With the development of technology, such as algorithmic recommendations, generative content creation and extended reality, the complexity of the communication system has risen significantly, and now laboratories need to model all kinds of communication environments rather than fixed processes. Therefore, the construction goal of the laboratory will be to achieve system flexibility rather than to ensure the stability of equipment. That is to say, the laboratory no longer wishes to reproduce the technical conditions of a particular kind of media institution; instead, it will take the new parameters obtained from the iteration of media technology as the starting point.

The three levels of the Logic of Displacement are: First, the time horizon for the construction goal has moved away from the current industry norm and is proactively responding to new forms of communication. Second, the main index for determining whether the goal has been achieved is now the algorithmic approximation of the simulation environment and the actual communication system. Thirdly, the discourse system of goal setting has changed from 'matching device functions' to 'the ability to regulate and intervene in communication variables'. Therefore, with the iteration of media technology, not only has the material composition of the laboratory changed, but so too has the internal reference framework for construction goals; now it is a dynamically adjusted goal-generation mechanism based on technological foresight rather than historical experience[1].

1.2 Functional Redefinition of the Laboratory: From Teaching Verification to Knowledge Production

The first function of the teaching-verification laboratory is to reproduce the results according to preset rules, and its operating logic is to enter the standard operating procedure and then verify whether the output meets the requirements. Previously, the function of journalism and public relations was to reduce the complexity of communication effects, gather public opinion and other information, and create media. With the development of algorithmicisation and data-driven media technology, new and irregular phenomena have appeared in the communication system, and the original rules are no longer sufficient to cover all combinations of variables in real communication. If the only goal of the laboratory is to teach verification, then it will be impossible to explain the problem of low reproducibility in communication systems, and no new explanations will be added to the knowledge system of this subject. Therefore, the function of the lab should be changed to that of knowledge creation, and it will no longer be limited to verifying existing conclusions but also produce new ideas, models and relationships.

First, the input condition for the functional redefinition of the knowledge-production-oriented laboratory will no longer be the standard teaching instructions; instead, it will be a configurable combination of experimental variables, and thus researchers can set their own communication parameters to observe the self-organised behaviour of the system. Secondly, the purpose of the operation logic is no longer to obtain the results directly but to build a cycle of hypotheses and tests; thus, the laboratory does not assume that the output will be correct and discovers potential correlations among variables through several runs. Third, the form of the output is no longer operational scores or equipment usage records; rather, it is a dataset, algorithm script, communication model, etc., that can be tested by the academic community. Therefore, the laboratory will take the initiative to build disciplinary knowledge and not be a passive recipient.

1.3 The Expansion Path of Laboratory Capability Dimensions in the Cross-media Integration Environment

Cross-media integration breaks down the traditional boundaries of different media, and the same communication event can be translated and distributed in many forms, such as text, pictures, sound, video, interactive interfaces, virtual spaces, etc. Given the reasons above, the laboratory of journalism and communication should expand the scope of application beyond the management of workflows for individual media. At the same time, the lab will also carry out the following in the lab: signal collection from all sides, codec conversion, content alignment and cross-modal retrieval. The old laboratory division is organised according to the type of medium, and there are problems of rigid division of labour and data silos in an integrated environment. The first appearance of capability dimensions is a change in perception at the level of perception from a single modality to a joint perception of multiple modalities, so a heterogeneous sensor array that can synchronously collect visual, auditory, tactile, positional and biological signals needs to be built in the laboratory[2].

The extended path will be the joined reconstruction of the processing layer and the output layer. Computational Units for cross-modal representation learning should be added in the lab at the processing stage to enable joint feature extraction and alignment modelling of text, image and audio data, thus information from different media forms can be compared and processed in a unified semantic space. Increase in the capacity dimension at the output stage is to change from single-channel broadcasting to multi-terminal adaptive distribution; that is to say, the content produced in the laboratory needs to automatically adjust encoding parameters and interaction modes according to the type of terminal and the circumstances of the user. At the same time, a system to evaluate the scale of laboratory construction should also be established, and indices such as the depth of multimodal fusion, the recall rate of cross-modal retrieval, and the latency of adaptive distribution can be used to determine how far along the construction of a complete closed-loop system of capabilities from perception acquisition to intelligent distribution has been.

2. Modular Design and Intelligent Embedding of Laboratory Technical Architecture

2.1 Collaborative Resource Allocation of Distributed Computing and Edge Nodes

The kind of data handled by the laboratory of journalism and communication includes high-bitrate videos, multi-channel sound, real-time sensor array signals, large-scale text corpora, etc. One central computer will not be able to meet the demands of low latency and high throughput. A distributed computing framework splits the calculation of a problem into many small pieces and distributes these small pieces among many computers or virtual machines to reduce the work of one machine and improve efficiency. The distributed computing in the technical architecture of the laboratory should work with the edge node to distribute the work of data preprocessing, feature extraction and real-time response near the source of the data at the edge, reduce the load on the core computing unit and lower cross-network transmission latency[3].

The goal of the main content in collaborative resource allocation is to build a timetable that can distribute tasks according to all sorts of conditions, such as the urgency of the data stream, computation demand and real-time idle capacity of nodes. Tasks that do not require low latency, such as offline analysis and model training, can be scheduled in the central computing cluster for large-scale matrix operations, and interactive perception signal processing that needs millisecond response times is done independently at the edge nodes. The distributed file system and message queue will keep the state and tasks of all nodes in sync, so even with a large number of users, the lab will be scalable and fault-tolerant. Cooperative Mode does not need to be set up in a particular place in the network, and it can be added or deleted freely according to the requirements of the experiment.

2.2 The Perception-Interaction Hierarchy Model of Virtualised Simulation Environments

A Virtualisation Simulation Environment can create virtual worlds, virtual media and simulated behaviour of people in communication situations to provide a controlled and reproducible experimental basis for journalism and communication. The goal of the Perception-Interaction Hierarchy Model is to list all the connections among perception channels and interaction rules at different levels of abstraction in the simulation environment, so that experiments can be conducted covering both the basic operation of the interface and complex multimodal information exchange. The three levels of this model are as follows: The bottom layer collects raw data from all directions, such as eye movement, distribution of touch pressure, body posture and voice commands, etc., converts them into discrete interaction events, and then the middle layer maps these events to changes in the state of virtual objects, and finally, the top layer infers the goal of the communication behaviour based on the time pattern of the interaction sequence to dynamically change the response method of the simulation environment.

The bottom layer and the top layer have a good interface protocol; that is to say, the lower layer provides data or event sequences for the upper layer, and the upper layer returns perception parameter adjustment instructions to the lower layer. The two above are not random associations; therefore, we can switch on or off certain levels according to the demands of different research problems. In the study of the usability of media interfaces, only the signal perception layer and the semantic mapping layer need to be used; for the study of intention-driven content generation, the whole hierarchical model must be employed. This model can be applied at all levels in the field of journalism and communication; that is to say, both fine-grained observations of behaviour and general patterns of social interaction can be studied.

2.3 Heterogeneous Integration Scheme for the Multimodal Content Processing Engine

The foundation for the production and analysis of cross-media content in the laboratory is the Multimodal Content Processing Engine, and its functional requirements include parallel encoding, feature alignment and joint generation of all kinds of information such as text, images, audio, video, three-dimensional geometric data, etc. The Plan for Heterogeneous Integration is to organise the scheduling of processing units with different computing architectures, such as Central Processing Units (CPUs), Graphics Processing Units (GPUs), Tensor Processing Units (TPUs), Field-Programmable Gate Arrays (FPGAs), etc., under a single software abstraction layer to meet the computational demands of all kinds of modal processing tasks. Processing of text and sequences has been employed to improve branch prediction and cache structure in CPUs; convolution operations for images and videos are carried out with the parallel streaming architecture of GPUs, self-attention computation in Transformers has been mapped onto the systolic array of Tensor Processing Units (TPUs), and low-latency hardware acceleration for real-time signal filtering and encoding parsing can be achieved using Field-Programmable Gate Arrays (FPGAs).

The basis for the plan of heterogeneous integration is a single computational graph abstraction and an automatic operator allocation scheme. Collect all kinds of input, and then the engine will build a directed acyclic graph (DAG) for processing, and each operator in the graph will have computational characteristic tags and data dependency information. Dynamically select an execution device that has a relatively low occupancy and good computational efficiency from the available processors, create a good data transfer path between devices, and avoid the bottleneck of frequent copies to and from main memory and video memory, etc. Pruning and Quantization-aware Training will be carried out according to the plan above to ensure that the compressed multimodal model has good inference accuracy on resource-constrained edge devices. Heterogeneous integration can be employed to achieve the simultaneous generation of text, synthesis of images and rendering of audio in a multimodal content processing engine at a relatively low total computational cost, thus meeting the combined experimental demands of the cross-media integration environment.

3. The Systematic Generation and Evolution Mechanism of Innovative Models

3.1 Collaborative Symbiotic Generation Logic Based on Niche Theory

Ecological Niche is the place where a certain kind of living thing lives and how it lives. Based on the above analysis, the laboratory of innovative models for journalism and communication should no longer operate in isolation as a collection of equipment; instead, it needs to be built as a node in the resource network and cooperate with all kinds of parties, such as hardware suppliers, software developers, data service providers, other multidisciplinary teams, etc. The first goal of the cooperative symbiotic generation logic is to help the laboratory proactively find deficiencies in the resource network and make up for them to obtain a necessary amount of life. Production is not the result of top-down design; rather, it is a structure that gradually emerges through continuous exchange of matter, energy and information between the laboratory and the outside world[5].

In order to achieve collaborative symbiosis, the laboratory should be able to both obtain and distribute resources. Based on the work mentioned above, some components of the high-absorption-capacity advanced media technology have been added to and used in laboratories. Therefore, new sensors have been developed, open-source algorithm libraries have been distributed locally, cloud computing resources have been rented or scheduled, and a spillover effect can also be observed in the open sharing of laboratory data, preprocessing tools, simulation scenario templates and experimental protocols with external parties. When absorption and spillover form a closed loop, the laboratory is no longer under the sole authority of one hierarchy or department; rather, it has become a function-oriented node in the resource network. The generation logic of this small group of people is neither fixed nor random; rather, it can be seen that innovation is an emergent structure resulting from many rounds of adaptive interaction between the laboratory and the outside world.

3.2 Agile Responsiveness and Iterative Path Adjustment

Both the external technical environment of the laboratory and the internal research needs are changing rapidly, so the old way of periodic updates will soon be outmoded. The dynamic adaptive iteration path is to add a nonlinear correction term that depends on the size and sign of the change signal. Therefore, the capability state of the laboratory can be regarded as a set of quantifiable and decomposable functional modules, each of which is a particular kind of data processing task or experimental operation procedure. When the new standards for new media technology are released or new requirements for variable control are put forward by the internal research team, the whole system does not need to be replaced; instead, only the corresponding function module will be selected for replacement, and then the parameters or interfaces will be modified/redesigned.

The three stages of the process of dynamic adaptation are perception, judgment and response. At the perception stage, the state-monitoring agent in the computing node and the sensor end continuously collect data on the speed of task execution, resource utilisation, failure rates of tasks, etc. Based on the above indicators, at the time of judgment, we will determine which modules have shown a decline in performance or are missing some functions. At this time, the laboratory will set up modules, update the algorithm model online, dynamically allocate computing resources, add redundant switches to the data transmission path, etc. The whole iteration process is either unlabelled or semi-labelled; thus, it does not need to be annotated by humans and is not subjective. With the development of new media technology, some improvements need to be made to the laboratory gradually so that it can keep up with the times and avoid falling out of date.

3.3 Platform-based Self-organising Evolution Rules in an Open Architecture

At the bottom of the laboratory, there will be an open-architecture system, and according to the circumstances, some off-the-shelf modules can be added or removed; platform-based self-organisation evolution rules will determine when and how such modifications are to be made. In short, the idea of self-organising evolution is that, in the absence of external control, the structure of the laboratory will spontaneously develop order and efficiency based on the interaction rules of local units. The three kinds of rules in the system are component registration and discovery; resource allocation and competition regulation; isolation and elimination of failed modules. All functional modules that need to use the platform should publish a standardised interface description and a dependency declaration, and then a global service directory will be built by the platform to query and call them. When many modules need to use the computer at the same time, quotas will be set according to the importance of the tasks, past performance and expected results. Modules that do not respond, have a very high error rate, or have not been used for a long time will be automatically disabled or archived by the platform[6].

Evolutionary rules have a way to observe behaviour change and then react to it. Periodically carry out topological analysis of the distribution of functions, connectivity density and response efficiency for the whole system in the laboratory to find clusters of important modules with a high number of invocations and isolated nodes with low redundancy. Based on the above analysis, the platform can automatically combine or separate modules, create new interfaces to optimise the whole structure, and increase the level of functional aggregation without the need for external commands. Self-organising evolution can help the laboratory of journalism and communication stop being a fixed technical instrument and become a computational media system with endogenous renewal; thus, the sustainability of the innovative model depends on the rules themselves and not on the development of individual modules.

Conclusion

The general plan for the construction of journalism and communication laboratories and the study of new model generation mechanisms will be introduced in this paper. The aim of the new type is to help the displaced people live better in a different place. The three parts of the Technical Design are

Edge Cooperation, Virtualised Perception-Interaction Hierarchy and Multimodal Heterogeneous Integration. According to the niche theory, it is also a cooperative symbiotic-generation type, and under the governance of platform-driven self-organising evolution rules, it has an agile iteration path. Therefore, the aim of a laboratory should be to construct an independent system for computational media, rather than to establish a particular place for technology. In the future, we will increase the level of human-machine collaborative intelligence in the laboratory, improve the construction of interdisciplinary resource networks, optimise the adaptive parameters of evolution rules, and further explore the limits of autonomous generation and regulatory thresholds for the laboratory as a node in the production of media knowledge.

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