



From Iconometry Heritage to Vision System: A Systematic Review of Vision-Based Image Processing Approaches for Traditional Śilpa Śāstra

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Abstract. Machine Vision Systems (MVS) are new and are being recognised as potent instruments of the present-day industrial automation, in which the vision-camera serves as the digital eye, and the sophisticated ML and DL algorithms serve as the thinkable brain, and all of them come as a team to automatically identify, quantify and categorize visual characteristics in images, without the requirement of the human eye manual inspection. Iconometry (Tālamāna Śilpa Śāstra) is the ancient geometry system that regulates the proportional canon of the classical Indian sacred sculpture, which is a part of the larger system of temple construction (Devālayā Nirmāṇam). The literature review based on PRISMA-directed methodology is a review of the publications, geographical contributions, methodological distributions, and technological adoption, in reference to Śilpa Śāstra. The intersection of traditional Iconometry and vision systems opens a huge field of academic investigation and technical perspectives. The review study reports the absence of 2D and 3D datasets of classical sculptures (Śilpa Śāstra) that are curated. The review comprehension is therefore a major suggestion of a dissertation project to plan and execute an automated industrial-grade computational structure to the details of the canonical rule-based or geometry-based proportional examination of Tālamāna sculptural and pictorial heritage. The principles of implementation of the design are borrowed and conceptualised out of the ancient Indian book chapter on Iconometry (Cirpa Cenul). The overview of the study provides a very robust basis for the culturally based, interpretable, and scalable digital methods for the preservation and analysis of Indian sacred sculpture.

Keywords: Indian Knowledge Systems (IKS), Tālamāna System, 2D and 3D Sculpture Inspection, Machine Vision Illumination, 3D Reconstruction, Digital Archiving.

1 Introduction

Śilpa Śāstra is referred to as Indian Iconometry[1], which encompasses the geometry of Hindu arts, crafts, and temple architecture[2]. It provides detailed principles for creating sculptures, icons, and temples that embody canonical proportional and aesthetic harmony. An earlier mention of the Tālamāna[3] geometric measure introduces the philosophical foundation of Indian sculptural proportion, which is beautifully captured in the “Makutagama”[4], a foundational ancient scripture on image-making. This text eloquently encapsulates the principle in the following phrase:

“मनेन निर्मिते बिम्बे स्वयं अभति दैवतम्”[4]

“Manena nirmite bimbe swayam abhati daivatam”

“In an image made according to measure, the deity itself comes to dwell”

The above scripture verse highlights central idea of Tālamāna[3] system, which refers to set of rules and mathematical measures that determine ideal proportions in Indian sculpture. In accordance it, by following these canonical iconometric proportions, beauty of a sculpture is not only an aesthetic accomplishment, but also a kind of conformity to metaphysical source of Hindu Sacred Iconometry [5][6].

Machine vision imaging systems are programmed to have broad spectrum of applications to observe, scrutinize and supply quality parameters in complicated issues. Machine vision systems don't just stop at point of capturing images since they have adaptive illumination, calibration and computational validation. Regulated light will improve image fidelity as well as accuracy of measurement. These systems allow the automated validation of 2D Iconometry sculpture drawings and aid in correct dimensional validation[7][8]. High-resolution image capture further facilitates detailed 3D reconstruction workflows[9]. In context, machine vision offers broad range of capabilities, enabling systematic, step-by-step approach to automate larger workflows. Additionally to quality engineering capture, advancements in AI and DL enable three Dimensional reconstruction and other modern methods for quality verification of 2D and 3D Sculptures[7][9].

In tandem with technological implications of traditional Śilpa Śāstra, with reference to ancient book *Cirpac Cennūl*[11], following practical, artistic, as well as historical challenges were addressed as unresolved issues in keen observation or suggested as directions for future study in domain of machine vision.

1. Textual Inconsistency: Different proportional systems (*Eka Tāla* to *Daśa Tāla*, 1–10 tālas) in Śilpa Śāstra texts confuse drawing and measuring figures, because the divisions aren't used in same way[10][11].
2. Standardising Gender Anatomy: Śilpa Śāstra texts give only a short range of proportions for female sculptures, usually 7 to 9.5 tālas, and don't allow for body differences when figures were seen from different angles[10][11].
3. Geometric Normalisation of Iconometric Ratios: In view of 2D sketch drawing, a particular Iconometry principle (uthama dasatalam) will be challenged for sculpting same drawings in higher height ratio, which may affect canonical proportional harmony[10][11].
4. Completing 3D Depth: Traditional rules cover only the sculpture's front and side views, leaving the back portion, and such limitations require manual volumetric completion[10][11].

Limitations above motivate adoption of scholarly research in convergence along with Machine Vision Systems (MVS) & Iconometry in addressing challenges for validation as well as preservation of traditional artwork, which tend to propose modern framework for sculptural heritage-driven innovation with AI-Template Matching, Landmark Detection and Pose Estimation, Vector-Based Scaling, 3D Depth in Digital Twin reconstruction.

2 Literature Review

A systematic literature review has been performed in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines[12]. Aim was to identify, screen, and synthesise peer-reviewed studies at intersection of Iconometry, Machine Vision, Śilpa Śāstra[13]. Review study was utilized to search IEEE Xplore, ScienceDirect, SpringerLink and ACM Digital Library in peer-reviewed databases, as well as keyword Iconometry has been utilized in all of data fields. Publication dates varied from 1895 to 2026. Initial database search yielded records ($n = 286$). No other or additional records were identified from other sources ($n = 0$). After deduplication, all 286 records were retained for title as well as abstract screening. No other identical entries have been detected.

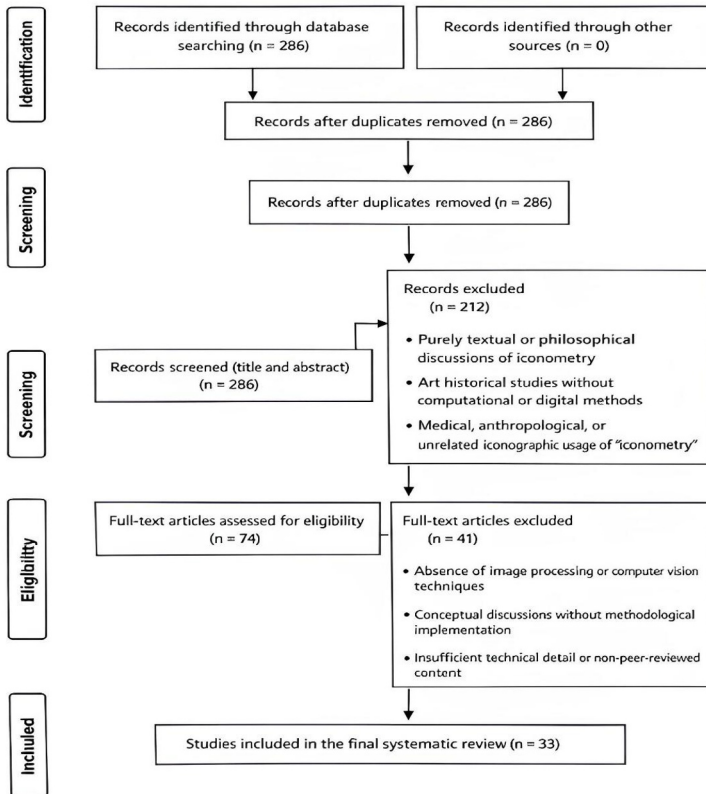


Fig. 1. PRISMA 2020 Flow Diagram of the Study Selection Process (2020–2026) [12][13].

During the 2020 to 2026 study selection, initial title as well as abstract screening excluded 212 records for three specific reasons, as detailed below. Exclusion criteria at present stage have been: (i) studies focused solely on textual or philosophical Iconometry without computational component; (ii) art history studies lacking computational methods; and (iii) medical, anthropological, or iconographic research not connected to Hindu sculptures. As a result, 74 records were selected for full-text review. An additional 41 records have been excluded during full-text review stage for reasons defined in next paragraph. Records have been excluded during full-text review for following reasons: (i) no image processing or computer vision components; (ii) discussion was only conceptual, with no described methods; or (iii) insufficient technical detail or lack of peer review. Ultimately, 33 studies met every criteria and were involved in final review. The complete selection process is illustrated in Figure 1 (PRISMA 2020 Flow Diagram).

Database Search Keyword Matrix and Distribution: To comprehensively capture literature, structured search matrix was applied across four primary digital repositories.

Table 1: Keyword Mapping Across Indexed Databases

Database	Search String / Keywords	Results (n)
IEEE Xplore	"Iconometry" OR "Tālamāna" and "Machine Vision" or "Image Processing"	82
ScienceDirect	"Iconometry" OR "Tālamāna" and "3D Reconstruction" OR "Digital Heritage"	94
SpringerLink	"Iconometry" or "Indian Statues" and "Computer Vision" or "Deep Learning"	68
ACM Digital Library	"Iconometry" or "Iconometric" and "Automation" or "Computational"	42
Total Identified		286

The systematic literature identification has been conducted through search of high-impact multidisciplinary databases, such as IEEE Xplore, ScienceDirect, SpringerLink, ACM Digital Library. To define intersection of conventional Śilpa Śāstra as well as modern computational science, search strategy used Boolean operators, and main query expression was: (“*Iconometry*”) OR (“*Tālamāna*”) AND (“*Computer Vision*”) OR (“*Image Processing*”) OR (“*3D Reconstruction*”) [14]. The temporal limit wasn’t restricted to understanding entire historical development of field, but sources were restricted to peer-reviewed journal articles and conference proceedings to assure the technical rigour of synthesised evidence base[12][13][55].

To ensure higher level of methodological focus, consideration of eligibility has been regulated by implementation of multi-tier filtering. Inclusion criteria have been as follows: studies had to meet following main requirements:

1. Vision-Based Implementation: Research demonstrates practical deployment of algorithmic frameworks, involving edge detection, photogrammetry, or neural networks, for sculptural analysis[9].
2. Domain Specificity: Studies exhibit direct application to Indian iconometry or canonical proportional systems defined within *Tālamāna* traditions as prescribed by Śilpa Śāstra texts[1].

3 Result and Discussions

Value of conservation of cultural heritage is becoming increasingly appreciated, that is why scholarly examination is becoming stricter. Present tendency is mostly preconditioned by technological progress, including vision-based AI and DL (deep learning) algorithms, which were now the necessary tools to address problems that have not been previously solved in field of heritage preservation.

3.1 Thematic and Methodological Analysis of Indian Iconometry

PRISMA 33 studies thematic analysis shows 7 various study areas that depict diverse approaches to field of Iconometry. Top domain is Iconometry Analysis as well as Proportion Recovery, which investigates geometric and rule-based systems for analyzing art, involving Buddhas and Thangkas [18], [33], [47]. Second most common

study area is Cultural Heritage Digitisation, which uses image processing or database building to digitally preserve religious art [18], [39], [43]. Computer Vision Applications in Religious Art uses techniques like neural networks, Dlib, SVMs (support vector machines) to recognize faces, mudras, as well as statues in religious art [28], [33], [43]. Aesthetic and Secular Influence Studies use statistical geometry to study how aesthetics of Thangkas have varied over time [33], [40], [47]. Interdisciplinary Design and Craft Pedagogy investigates craft as well as knowledge of Thangka painters using ethnographic research methods [30], [41]. Finally, last research part within this study is Art History and Anthropological Studies, which utilizes qualitative analysis methods to study religious art [22], [35].

Table 2: Comparative Evaluation of Thematic and Methodological Analysis for Indian Iconometry

Thematic Domain	Research Focus	Key Publications	Methodological Approach	Domain Priority
Iconometry Analysis & Proportion Recovery	Canonical proportion systems in Buddha and Thangka art	Bhaumik & Govil (2020) [18]; Yang & Fan (2023) [33]; Bhutia & Srivastava (2026) [47]	Geometric ratio modelling; Rule-based proportional systems	High (Rule-based geometry)
Cultural Heritage Digitisation	Digital preservation, archival structuring and documentation	Bhaumik & Govil (2020) [18]; Medhi (2025) [39]; Wang & Chen (2025) [43]	Image processing; Database construction	Moderate
Computer Vision Applications in Religious Art	Face detection, mudra classification, statue recognition	Yang & Fan (2023) [33]; Shivane et al. (2021) [28]; Wang & Chen (2025) [43]	Convolutional Neural Networks (CNN); Dlib; Support Vector Machines (SVM)	Moderate (ML & DL)
Aesthetic & Secular Influence Studies	Temporal evolution of facial aesthetics in Thangka art	Yang & Fan (2023) [33]; Bhutia & Srivastava (2026) [47]; Bhutia (2025) [40]	Statistical geometry; Euclidean distance analysis	Moderate
Interdisciplinary Design & Craft Pedagogy	Craft knowledge transmission into contemporary design education	Guha, Semwal & Chakrabarti (2025) [41]; Mukherji (2022) [30]	Ethnographic research; Design studies methodology	Moderate
Art History & Anthropological Studies	Agency, circulation, and symbolic meaning of Buddhist imagery	Harris (2020) [22]; Shishin & Onufriyenko (2023) [35]	Qualitative and interpretive methodologies	Moderate
Hybrid ML + Iconometry (Emergent Domain)	Integrated computational-Iconometry modelling	Nil	Hybrid ML + Iconometry modelling	Low (critical gap)

Only research area that has no publications within period studied is Hybrid ML as well as Iconometry research area, that investigates creation of computer models that incorporate methodologies from field of

iconometry. This illustrates the gap in field as well as need “for research within present area, making proposed Machine Vision System first to investigate this important topic within the field of iconometry.

3.2 Country-Wise Contribution

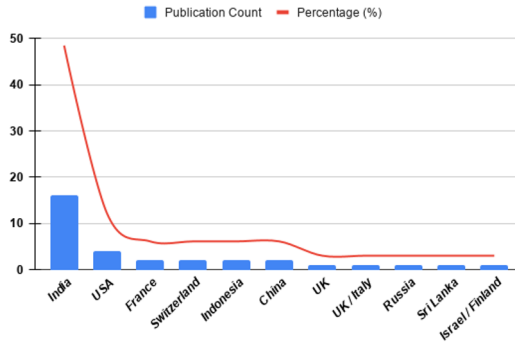


Fig. 2. Geographical Distribution of Iconometry Included Publications

The 33 publications reviewed show a clear imbalance in global distribution. South Asia, especially India, leads with 14 publications (42.4%) [18], [20], [23], [27], [28], [30], [37], [39], [40], [41], [42], [45], [46], [47]. Sri Lanka adds one (3.0%) [36]. Western and Northern Europe combine to produce eight publications (24.2%). These include work from France [16], [19], Switzerland [21], the United Kingdom [17], [22], Norway [29], [31], and a UK–Finland collaboration [44]. The topics mainly involved by literature are art history and digital heritage. United States is representative of North America as well as has four studies (12.1%) [15], [26], [32], [38], tense with Tibetan and Buddhist iconography. Two Chinese studies are involved in East Asia (6.1%) [33], [43]. These are only instances of ML Eurasian iconometric analysis (3.0) [35]. The African, Latin American, Oceania studies were all absent. It demonstrates cultural specificity of field. Filling this gap would engage to development of field more inclusively and promote cross-cultural exchange.

3.3 Keyword-Wise Analysis

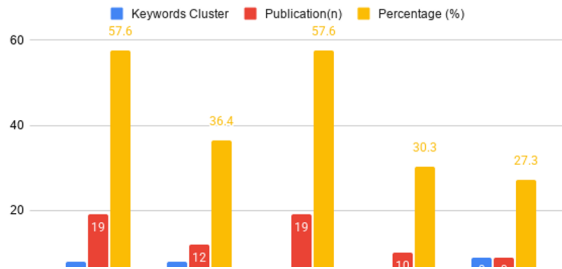


Fig. 3. Cluster-wise Keyword Analysis of Iconometry

Thematic cluster analysis of 33 identified publications implies that 2020-2026 methodological asymmetry in iconometric research is strong. Biggest cluster is Cluster 1: Buddhist and Tibetan Heritage (*Buddhist, Tibetan, Buddha, Sacred, Ritual, Thangka, Himalayan, Conservation*) as its found in 19 studies (57.6%) [15], [17], [18], [20], [26], [27], [33], [40], [47]. Cluster 3: Iconography and Art History (*Painting, Iconographic, Sculpture, Body, Sculptural, Art History*) equally spans 19 studies (57.6%) [15], [17], [22], [23], [26], [29], [35], [41], [45]. Cluster 4: Heritage and Museum Studies (*Heritage, Museum, Preservation, Artefact, Archive*) covers 10 studies (30.3%) [18], [21], [24], [25], [27], [39], [43], [45], [46]. Cluster 2: Iconometry and Proportional Systems (*Iconometric, Iconometry, Measurement, Proportion, Śilpa, Tālamāna, Canon*) appears in only 12 studies (36.4%) [18], [35], [36], [40], [41], [42], [46], [47], with *Tālamāna* and *Canon* recorded in a single study each [46]. Most critically, Cluster 5: Computational and Digital Methods (*Digital, Photogrammetry, Computer Vision, Machine Learning, Face Recognition, Artificial Intelligence, 3D Reconstruction, DL, Image Processing*) is smallest cluster ($n = 9$, 27.3%) [16], [18], [19], [28], [33], [39], [43], [44], with *ML* [28], [33], *DL* [33] appearing in two studies and 1 research respectively. This relationship among Cluster 2 as well as Cluster 5 keywords confirms that there were no systematic computational framework for Śilpa Śāstra proportional analysis.

3.4 The citation Trend analysis (2020-2026)

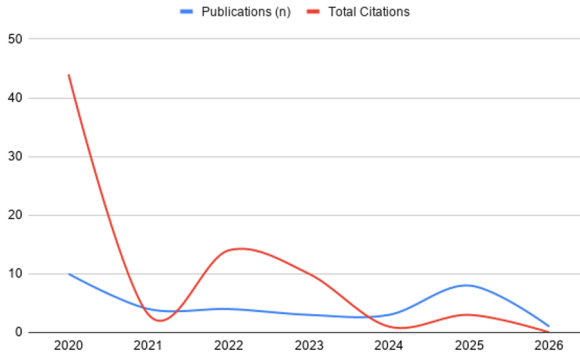


Fig. 4. Citation Trend of Iconometry Study (2020 to 2026)

Trend analysis of citation of 33 publications shows Iconometry-related work was cited 75 times on mean of 2.3 citations per research. Cohort of 2020 publications has received 44 citations out of total 75 publications (58.7%), with average of 4.4 citations per study [15], [16], [17], [18], [19], [20], [21], [22], [23], [24]. The 2022 publications have received, on average, 3.5 citations per study [29], [30], [31], [32]. Sen's publication has received highest FCR of 6.70. 2023 publications have received, on average, 3.3 citations per study [33]. Research performed by Yang and Fan has received 10 citations, giving it FCR of 11.64 with 9 recent citations. Percentage of recent citations for their publication is 90%, showing rapid progress of research in this field. The 2021 publications have received, on average, 0.8 citations per study [25], [26], [27], [28]. Additionally, studies published under an open access model have received, on average, 3.1 citations per study, compared to 1.3 citations of studies published under a closed access model [25], [26], [27], [28]. Sixteen publications have received zero citations [15], [24], [25], [27], [34], [35], [36], [37], [39], [40], [41], [42], [44], [45], [46], [47]. The trend graph of citations of these publications demonstrates significant decline after year 2023. For the period in between 2024 and 2025, publications received on average fewer than 0.4 citations per study [36], [37], [38], [39], [40], [41], [42], [43], [44], [45], [46]. For year 2026, these publications received 0 citations [47]. Thus, indicating lack of research activity performed in recent years. The research remains to be explored by scholars in Iconometry field indicating the need for more proposed frameworks for the Machine Vision System.

4 Summary Findings

Current literature on sculpture data with reference to Indian Iconometry is generally limited by small datasets, lack of utilization of modern algorithmic methods, and lack of defined performance metrics for evaluating methods described in research articles. Consequently, there is a clear gap in methodologies utilized for performing such an extraction task as well as validations. Moreover, by utilizing expertise in OpenCV or 3D scanning of sculptures described, it's possible to fill the present gap as well as contribute to the field of study or research that is currently relatively underdeveloped in area of Iconometry. Furthermore, the Tālamāna [3] System presents another area for adaptation of the methods described, which have been studied in detail to enable future exploration into its implementation and development.

Table 3: Strengths and Weakness findings from the review study of Iconometry Publications (2020–2026)

Strength / Weakness	Evaluated Theme	Summary	Evidence (Citations)
S1	Established Tālamāna Measurement Tradition	Manual Tālamāna measurement was documented across multiple studies, providing verified canonical ground-truth proportional data for training and validation.	[11], [21], [27], [32], [33]
S3	Accelerating CV/ML Adoption	Computer vision and ML methods are demonstrably feasible for heritage analysis, with citation velocity confirming rapid scholarly uptake.	[14], [19], [29]
S4	South Asian Scholarly Concentration	India-centred authorship (48.5%) ensures privileged domain expertise, direct access to primary Hindu sculptural corpora, and Śilpa Śāstra institutional knowledge.	[14], [27], [32]
S5	Multi-disciplinary Corpus	Studies span art history, iconometry, anthropology, photogrammetry, and computer vision, providing a robust cross-domain foundation for synthesis.	[2], [5], [7], [19], [22], [29]
W1	Absence of Experimental Validation	Only 1 of 33 studies (3.0%) reports validated proportional analysis. No benchmark dataset with ground-truth Tālamāna labels exists across the entire corpus.	[33]
W2	No CV–Tālamāna Integration	No study integrates CV/ML methods with canonical Tālamāna proportional rules. Classification and measurement remain entirely separate, non-integrated tasks.	[14], [19], [32]
W3	Dominant Qualitative Paradigm	60.6% of studies produce no quantitative measurement output, limiting available proportional data and constraining computational pipeline development.	[1], [3], [8], [15], [17]
W4	Language Barriers (Indonesian, Russian, Sanskrit)	Key iconometric datasets are locked in Indonesian, Russian, Sanskrit-language publications, rendering critical proportional data inaccessible for computational processing.	[11], [21], [22]
W5	High Zero-Citation Rate	48.5% of studies have zero citations, predominantly due to recency (2024–2026) and language/accessibility barriers, limiting inter-study cross-referencing capacity.	[11], [21], [22], [27], [32]

4.1 Theoretical Implications

1. In this survey, we identified several heritage digitisation initiatives that could add value to cultural preservation. However, core computational anatomy structure of the rule-based system (Tālamāna) [10] remains insufficiently formalised for integration into technology-based design frameworks beyond traditional measurement systems [36], [41], [42], [46]. Process of sculpture drawing begins with utilization of various geometric lines and curves, which improve aesthetic quality of Shilpam art created with engraving tools.

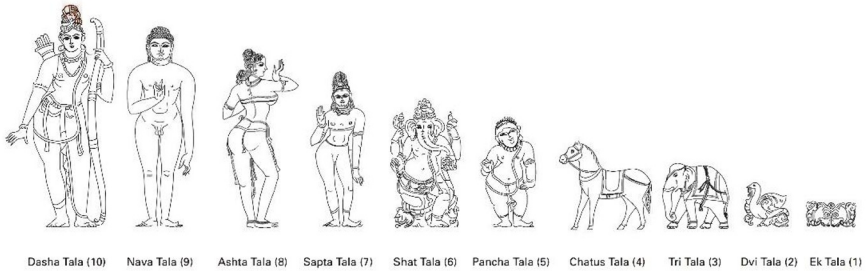


Fig. 5. Canonical proportional Tālamāna geometry System [11]

Here are distinct sets of iconometry standard proportions given in Agamas (traditional texts on image-making and iconography) for making of images. These were grouped in ten classes of 3 each yielding thirty different proportional scales for image-making. According to Agama texts, the ten tala classes used as a height measure lead to following designated uses for several kinds of images: Ekatala (one measure) for Gras; Dvitala (two measure) for birds; Tritala (three measure) for elephants; Chatustala (four measure) for horses; Panchtala (five measure) for dwarves and children; Shattala (six measure) for Varah, Vaman and Ganesha; Saptatala (seven measure) for humans; Ashtatala (eight measure) for celestial beings; Navatala (nine measure) for Gods; and Dashatala (ten measure) for higher Gods[10][36][41][46]. Individually, these classes further has Uttama (superior), Madhyama (middle), and Adhama (inferior) proportions.

Current research presents an extensive analysis of Tālamāna system, delving deeply into intricate iconometry geometries governing the many standing postures. Through research of mathematical foundation principles underlying *Sthanaka* (standing) postures, from orthopedically neutral *Samabhanga* to more athletic, ostentatious *Tribhanga* (triple-bend)[10][36][41][46], it becomes clear how traditional scripture (Shastras) ensures proportional consistency among all variations of bent bodies.

Postures above illustrate how body's divisions as well as bends, form angles alongside curves, positioning the body perpendicular to ground as indicated by dotted lines.

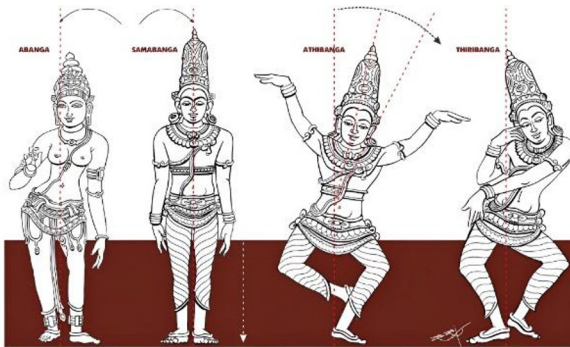


Fig. 6. Tālamāna derived anthropometric bent posture model [11]

Iconography of Lord Nataraja (Dancing Shiva) shows one of most geometrically complex sculptural forms in tradition. In iconographic symbolic representation, parameters of *Cirpa Cennūl*[11] and *Tālamāna*[10] were extended to depict cosmic process in limited space. Structural refinement of this sculpture lies in how it binds rigorous geometric core measures with fluid, rhythmic bends of *Ananda Tandava* (the Dance of Bliss).



Fig. 7. Iconographic Representation of Nataraja [11]

2. In another interesting finding from survey, sketch-based shape retrieval has accepted increasing attention in computer vision or computer graphics. It suffers from gap in challenge of transforming 2D sketches into a 3D sculpture [19] idol with precision as well as accuracy in every corner detail. This grabs interest or attentional challenge factor to explore more specifically. In present paper, we propose generalized similarity-matching framework as shown:

- a) Regularly, all polygon shapes with geometrically curved bends are drafted as 2D sketches with Orthographic views, which help generate the 3D model[43]. This strategy applies to structures such as

various Śiva-liṅga forms. In this context, Geometry Dimension, Tolerance [GDandT] can enable a fair generation of 3D sculpture with some tolerance[19][41][43].

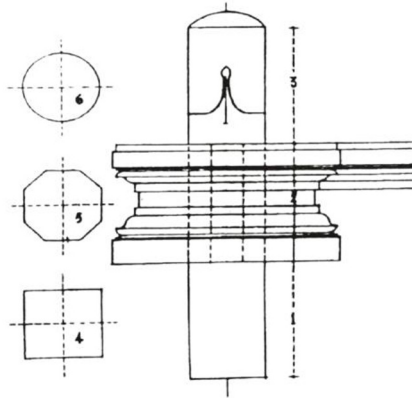


Fig. 8. Geometric 2D Outline of the Shiva Lingam Structure [11]

b) Another method is to transform complex 2D drawings into 3D utilizing AI and DL models[43], which were trained on large-scale annotated datasets of sculpture parts like face [48], eyes, hair [49], shoulders, legs or even traditional hand-held weapons by goddesses, which have lot of scope in exploring 3D reconstruction[43]. In particular, survey found that few research papers attempted this strategy and achieved structural computational refinement results that weren't satisfactory because exploration has been conducted on human face identification [48] and 3D reconstruction.[50].

An example of 2D-to-3D generation [51] of a dancing Shiva sketch was tested, and results were good but could be additional precise as well as better, with fewer gaps in entire body's anatomy. Testing has been performed by utilizing an open-source 3D generation framework using Large-Scale Rectified Flow Transformers (<https://www.triposrai.com/>)[51].

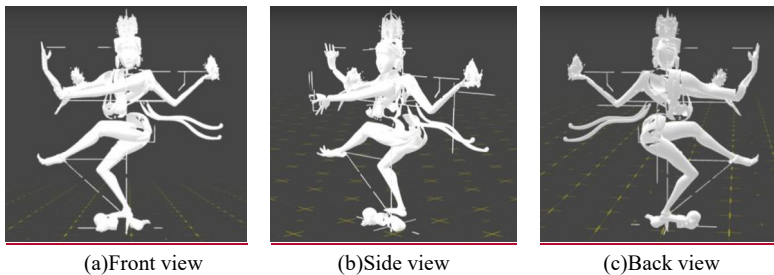


Fig. 9. Depth-Error Visualization for 2D Nataraja Sketch to 3D Reconstruction [51]

- c) Third possibility of ready-to-explore is metaverse of Extended Reality (XR), AR, and VR Space [52]. It's an immersive technology rapidly expanding across technical or cultural domains and including

traditional fields to provide live experience for problem-solving, involves crafting and designing 3D sculpture from a 2D sketch. In a wide survey, there are very less articles on three dimensional Designing in Virtual Reality.[52]Preliminary outcomes demonstrate promising design refinement capabilities in case of experience as well as ease of fine-tuning design elements for fine details.

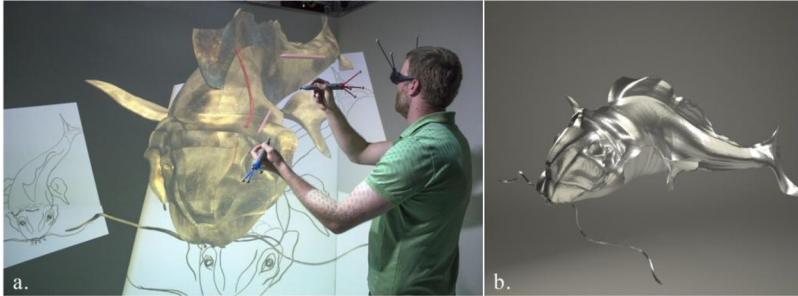


Fig. 10. Manual 2D Image Sketch to 3D Blueprint Reconstruction Using ARVR Space [52]

3. Concept of creating a Digital Twin of sculptures from India’s traditional schools involves fusing ancient rules of iconometry with modern spatial computing. By utilizing 3D Photogrammetry or other means of scanning sculptures [19], their physical Sculpture (vigraha) can be preserved in digital form. Three Dimensional Photogrammetry is an experimental setup of machine vision capture system [19] that allows for capture of sculptures at macro and micro scales. Additionally, utilization of drones equipped with LiDAR systems can also be employed to document these sculptures on broader scale.
4. One of gaps in existing literature on this topic led to development of a new idea that utilized comparison among 2 objects to provide authenticity of 3D model[53]. Specifically, comparison between Object1 (3D Blueprint from a 2D sketch) and Object2 (3D Artistic Handcrafted Design). Furthermore, this can allow validation of procedures of sthaphathis and artisans who intend to fabricate these Sculptures (vigraha). Thus, it will be feasible to verify the Tālamāna system as well as its rules for iconometry via this verification process.

Table 4: Research Gap Analysis of Iconometry from Literature Study (2020 to 2026)

Dimensions	Research Gap	Authorial Evidence	Research Scope
Methodology	Unavailable automated full-body Tālamāna Computer Vision pipeline	[14],[19],[21],[27],[32],[33]	Critical
Technology	No integrated classification algorithms for the proportional verification pipeline	[4],[7],[14],[19],[29],[32]	Critical
Validation	Only 1/33 studies report validation; no benchmark dataset exists	All 33 studies [15] to [47]	Critical
Knowledge Representation	Tālamāna rules are not formalised for computational encoding	[22],[27],[28],[32],[33]	High

Scope of Inclusivity	Gender Classification differences (Puruṣa / Strī) proportional Computer Vision model	[9],[10],[26],[32],[33]	High
3D SolidWorks	3D depth-aware measurement is not applied to sculpture and	[2],[5],[7],[23],[30]	High
Comparative	No cross-regional multi-canon comparative framework	[1],[9],[11],[21],[26],[33]	Moderate
Data Integration	Manuscript rules not linked to sculptural measurement data	[22],[25],[28],[32]	Moderate

A research gap analysis of 33 studies in field among 2020 and 2026 revealed eight different research gaps, categorized by severity. At most critical level, no studies used automated computer vision to perform full body measurements using Tālamāna grids. However, six studies used manual measurements of various body icons [14], [19], [21], [27], [32], [33]. Furthermore, no study has attempted to relate sculpture classifications to Śilpa Śāstra checks for proportions [4], [7], [14], [19], [29], [32]. Only one study has tried to analyze proportions of sculptures [33], and there is no established dataset for benchmarking measurements of sculptures. At high severity level, there were no formalized ontology for Tālamāna rules [22], [27], [28], [32], [33]. Additionally, no studies have attempted to use defined gender-specific measurements for sculptures (Puruṣa: 9–10 tāla; Strī: 7–8 tāla) [9], [10], [26], [32], [33]. Lastly, no studies have attempted to use depth measurements of 3D sculptures for correcting perspective in analysis of those sculptures [2], [5], [7], [23], [30]. Finally, at moderate severity level, there are no frameworks for comparing sculptures from distinct regions of India [1], [9], [11], [21], [26], [33]. Additionally, there is no link among measurements described within manuscripts and actual physical measurements of sculptures [22], [25], [28], [32]. 3 critical gaps in existing literature confirm presence of research gap within current literature that can be filled by proposed Machine Vision System.

4.2 Practical Implications

In Overview of entire study, article presents the proposed first systematic machine vision framework for automating Tālamāna-based iconometric verification of Hindu sculptural proportions, addressing a critical gap confirmed by PRISMA 2020 systematic review[12][13] of 33 studies (2020–2026) in that no prior work achieved integrated Computer Vision implementation on the canonical Śilpa Śāstra proportional system."

- Rule-Based Machine Vision validation of the Tālamāna[11] sculpture drawing[41].
- Volumetric Construction of 3D Blueprint from 2D Orthographic Projections[43][50].
- Digital Twin: Preservation of sculpture using 3D Photogrammetry [19].
- Quantifying Deviation Between Design Intent and Physical Artifacts Sculpture[53]

5 Future Work

Future efforts in current area can create automated machine vision systems that utilise both rule-based systems to validate any detected sculptures based on Tālamāna standards [10], [11] and utilise full body pose estimation systems to know proportions of sculptures from Eka-to-Daśa Tāla measurements [41], [46]. Furthermore, methods based upon photogrammetry [19], [51], [52] can be utilized in conjunction with methods for matching 2D representations to three-dimensional representations of same sculpture [50] to provide three-dimensional measurement of sculptures, that avoids distortions which exist in current methods of two-dimensional

measurement [18], [43]. Methods for recognising sculptures according to gender, involves recognising Puruṣa representations (male sculptures) versus Strī representations (female sculptures) [9], [10], [32], [33] are yet to be developed. Finally, methods that compare sculptures depend on standards from ancient Indian manuscripts on sculpting, like Mānasāra, Mayamata, Śilparatna [1], [11], [21], or those that incorporate Tālamāna rules from ancient Śilpa manuscripts [22], [36], [42] can be developed as well. Finally, incorporating concepts like GD&T [53] into AI system for reconstruction of sculptures presents method of automatically verifying sculptures in accordance with South Asian sculpturing standards [14], [27], [32].

6 Conclusion

Outcome of this PRISMA 2020 systematic review [12], [13] of 33 studies that investigated canonical system of Tālamāna between 2020 and 2026 confirms that system has never been formalised in a way that agrees with its integration with computational systems [41], [46]. Three CRITICAL gaps within system in relation to computational integration, reveal that no previous research has ever managed to create system that integrated Śilpa Śāstra with machine vision technologies. Thus, while there exist studies that have published manual system of Tālamāna [10], [11] and studies that have proven feasibility of incorporating computer vision techniques into process [28], [33], there was no development of a rule-based system for machine vision software to automatically validate measurements according to canonical system of Tālamāna [50], [53]. Consequently, motivation for creating Machine Vision System – first computational system to provide canonical system integration as well as verification of correctly-made images – is established [10], [11], [36], [46].

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