Decolonizing Knowledge Organization: Indigenous Knowledge Systems in Library Classification

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Abstract - **Purpose: Library classification systems, like the Dewey Decimal Classification (DDC) and the Library of Congress Classification (LCC), have been underpinned by Western epistemologies, which often marginalize or misrepresent Indigenous Knowledge Systems of management. This system of colonialism denies access to Indigenous knowledge and does not reflect Indigenous worldviews, languages, and relationships with land and community. The objective of this research is to offer an artificial intelligence (AI) facilitated method of decolonizing library classification through the identification and reclassification of Indigenous knowledge materials in a manner that is respectful and representative of Indigenous thought. Methodology: A corpus of more than 500 libraries was compiled. Preprocessing consisted of data cleaning, normalization of subject heading, and removing duplicate and irrelevant records. Feature extraction was term frequency-inverse document frequency (TF-IDF) and word embedding to extract semantic patterns in the metadata and descriptions. This research proposed a new tool, Malleable Migrating Birds Optimized Bidirectional Encoder Representations from Transformers (MMBO-BERT)-based classification tool, which picks culturally insensitive expressions, detects misplaced information, and suggests placement in Indigenous taxonomies and themes determined in consultation with Indigenous scholars. Results: Python was used for the implementation and experimental results demonstrate the research using human expert judgment to classify misclassifications and suggest reclassifications. The MMBO-BERT methodology performed better in Accuracy at (93.1%), Precision at (91.8%), Recall at (94.3%), F1-Score at (93.0%), and Cohen's Kappa at (0.83). Conclusion: Decolonization of**
knowledge organization is possible through the use of AI, which can enable libraries to reclassify classification systems more inclusively.

Keywords: **Knowledge Organization, Recommended Reclassifications, Detects Misclassified Information, Malleable Migrating Birds Optimized Bidirectional Encoder Representations from Transformers (MMBO-BERT), Library Categorization Systems**

I. INTRODUCTION

Classification schemes in libraries have been developed using prevailing epistemological paradigms, which have solidified colonial ideology and organized patterns of knowledge (Zahedifard et al., 2015). The Indigenous Knowledge Systems (IKS) techniques are relational, context-based, Detects and inclusive; these classification systems tend to minimize, mislead, or marginalize (Isaac et al., 2025; Biswas & Tiwari, 2024). Library classification systems, as stores of human information, are essential in determining how knowledge is accessible, valued, and preserved (Gazing et al., 2024). Epistemic injustice endures because of this incompatibility, which allows colonial rule of knowledge institutions (Frid et al., 2023; Alhassan et al., 2024). It is essential to recognize and solve these limits in knowledge organization and information retrieval techniques for the sake of equity, inclusivity, and respect for many intellectual traditions (Deen et al., 2025). Predominant library structures usually marginalize or misclassify Indigenous knowledge

structures revolving around oral traditions, relational insight, and universal holism (Fisk et al., 2025). This adds power to epistemic injustice and results in the marginalization of great cultural insight. By admitting and embracing alternate means of understanding, decolonizing knowledge arrangement strives to overthrow such hegemonic constructs (Das, 2025). Rethinking subject headings, metadata processes, and classification standards is needed to render them responsive to an array of concepts. Diversity can be supported, Indigenous voices promoted, and equitable access to knowledge facilitated without compromising the cultural integrity of all communities through decolonial practices (Owolabi et al., 2022). The IKS management is intricate systems of values, beliefs, practices, and knowledge that have been developed by Indigenous peoples through centuries of intimate engagement with spiritual, cultural, and natural worlds. Identity, language, and oral tradition are embedded in IKS management and are community-based and holistic (Turner & Reid, 2022). Through narrative, observation, ritual, and direct exposure to the earth and its people, knowledge is transmitted (Yabang et al., 2025). With basic values intact, Indigenous knowledge systems evolve as adaptive and dynamic systems. IKS management is recognized and appreciated, challenging existing paradigms in knowledge organization and allowing for inclusive, culturally sensitive library classification methods (Fa & Luiselli, 2025; Azoury et al., 2024). There are numerous issues involved in incorporating IKS management into library classification, such as linguistic differences, optimizing bidirectional dominance of the paradigm, and incompatibility of epistemologies (Padhye & Shrivastav, 2024). Traditional knowledge systems tend to be inflexible and cannot handle oral and relational types of knowledge (Kumar et al., 2022). Moreover, whenever Indigenous worldviews are reduced to rigid, hierarchical systems, they risk misinterpretation or appropriation, failing to express the richness of thought they embod.

Research objective

To tackle the above concern, the research develops an AI-assisted model that accurately recognizes and reclassifies Indigenous knowledge materials to decolonize library classification systems. To find misclassifications and map records to Indigenous epistemologies, it presents the MMBO-BERT technique. The objective is to improve Indigenous resources' visibility in library databases, cultural accuracy, and inclusivity.

Research Contribution

- Introduced an AI-based classification model, MMBO-BERT: Created a new MMBO-BERT method to precisely detect misclassified Indigenous materials and optimize metadata reclassification.
- Facilitated Indigenous-informed taxonomy integration: Enabled culturally sensitive reclassification by integrating Indigenous knowledge structures into library classification systems.
- Enhanced semantic understanding of library metadata: Used TF-IDF and word vectors to improve context comprehension and overcome colonial prejudices in subject headings.

Rest of the research

The rest of the portion was organized into the following sections: Section 2 related works. Section 3 covered material and methods, results and discussion were depicted in Section 4, 5 and conclusion was given in Section 5.

II. LITERATURE REVIEWS

Indigenous knowledge is increasingly acknowledged as an essential component of global environmental knowledge, formerly dismissed as merely folklore. In an analysis of the intricate history of creating conceptions of Indigenous knowledge, scholars have pinpointed the variables that shape views (Bocking, 2023). Change in knowledge and politics, especially in the Arctic, has been made possible in large part by indigenous peoples, who act as intermediaries and producers of knowledge. The Indigenous knowledge's contribution to disaster risk understanding, with a particular emphasis on floods in the Rwenzori region (Bwambale et al., 2022). It was discovered that lived experiences and open knowledge production in cultural institutions affect Indigenous knowledge based on data gathered through participatory ethnographic methods and examine using an inductive-analytical approach. This method emphasizes how crucial indigenous viewpoints are to comprehending context-specific disaster risk, underscoring the necessity for stronger scientific data. The Ministry of Education in British Columbia (BC) required that K–12 curricula include local Indigenous knowledge, pedagogy, and worldviews explored by (Prest et al., 2021). Indigenous cultural traditions are unknown to a large number of BC music educators. To find effective strategies for incorporating Indigenous knowledge into music classes, case research was carried out. According to participants, spoken instruction in drumming and singing promoted mutual respect and cultural understanding. The Decolonizing Race Theory framework to analyze an Aboriginal cultural mentoring program in Australia and examine Indigenous-led teacher professional learning for the development of culturally responsive practices in education is analyzed in (Burgess et al., 2022). The results indicate a greater level of confidence in establishing relationships with Aboriginal communities and implementing culturally responsive curricula but also highlight systemic issues for bettering the outcomes of Aboriginal students (Gazing Wolf et al., 2024).

IKS management is focused on re-appropriating knowledge that was not allowed to exist, enhancing human understanding, and promoting it (Odora Hoppers, 2021). In a decolonized context, IKS management requires ethical thinking, affirming the multiplicity of worlds, creating a shared paradigm shift, self-reflexive praxis, and critical

exploration of possibilities, new evaluation criteria, and transformation to new futures (Nwosu & Adeloye, 2023). The collection of place-based knowledge gathered over many generations in diverse cultural contexts is known as IK as determined in (Jessen et al., 2022). It is being used more and more in non-Western scientific research to improve knowledge of physiology, ecology, evolution, and applied ecology. Procedures and results to benefit both parties, scientists can respect Indigenous peoples' right to self-determination. The impact of digital-indigenous KC (D-IKC) on cultural transmission, social connections, and identity in New Zealand explored (Liew et al., 2021). It found that D-IKC benefits cultural heritage, but concerns about digital access, competency, and cultural values need to be addressed. The research also highlighted the importance of understanding the intersection of individual needs, cultural expectations, and norms in digital information environments. The Western positivistic research that disembodies Indigenous people's histories, worldviews, and practices,

non-Indigenous scholars have historically helped colonization determined (Ali et al., 2022). To promote a strength-based strategy that supports Indigenous ways of enabling health and well-being, systems theory and symbolic interactions can be researched in concert to create greater knowledge of Indigenous holistic perspectives, experiences, interpretations, and actions.

III. METHODS

The colonial legacy ingrained in historical library classification schemes that frequently obscure, marginalize, or disregard Indigenous Knowledge Systems is addressed in the research. It examined how to use AI to organize knowledge while incorporating Indigenous worldviews. Creating a classification system that is more accurate, inclusive, and courteous is especially important. Fig.1 presents the schematic diagram of the methodology flow.
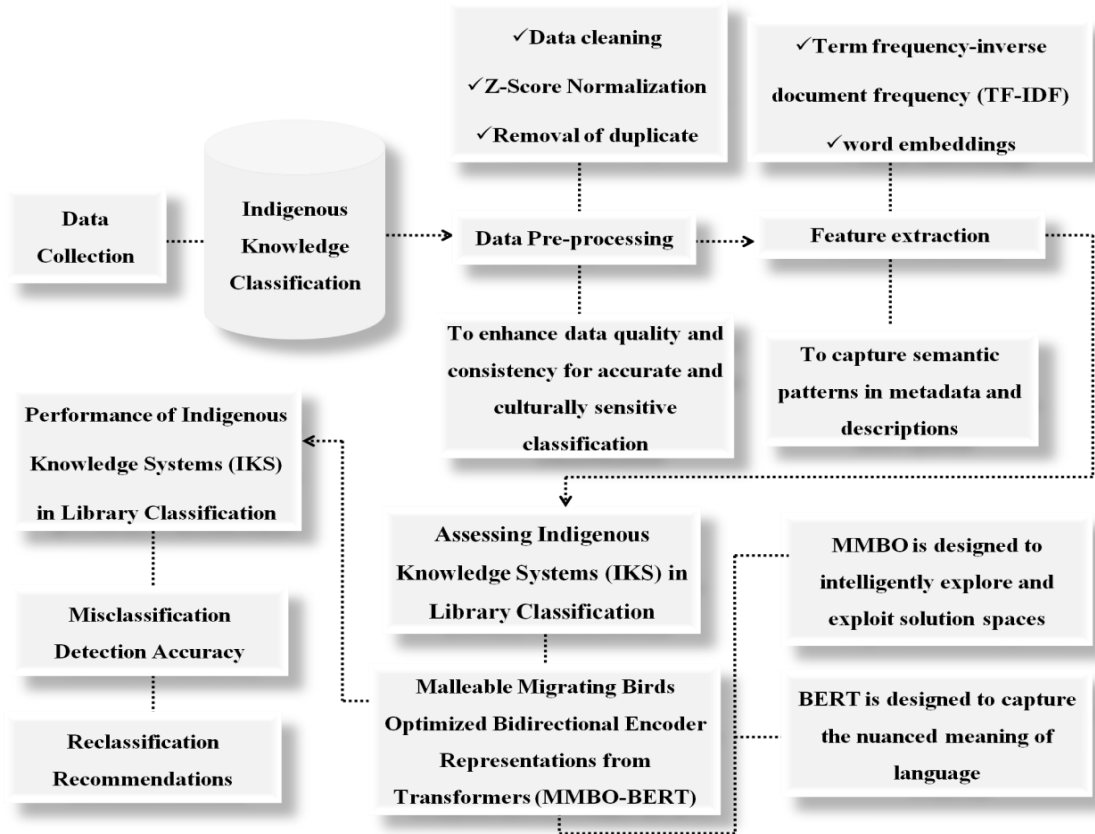

Fig.1 Schematic diagram of methodology flow

Data Collection

The Indigenous Knowledge Classification dataset was collected from the open-source Kaggle website: https://www.kaggle.com/datasets/ziya07/indigenous-knowledge-classification/data. This data set has more than 500 library entries of Indigenous knowledge systems designed to facilitate decolonization in library categorization systems. It has book titles, subject headings, classifications, and descriptions that reflect a wide diversity of Indigenous

viewpoints on matters, such as land management, spirituality, medicine, and community knowledge.

Data Pre-Processing

Data preprocessing, including data cleaning, duplicate removal, and Z-score normalization, is essential for accurate AI-assisted reclassification in decolonizing knowledge organization. These procedures enable equal representation of IKS, eliminate colonial biases, and correct inconsistent information. Library classification schemes that are

inclusive, respectful, and culturally integrated are made possible by clean and standardized data, which makes pattern detection more efficient.

- *Data Cleaning:*

In decolonizing knowledge classification, data cleansing is an indispensable step in preconditioning library records for effective reclassification that honors Indigenous Knowledge Systems. Typical metadata is likely to have discrepancies, colonial overtones, or archaic subject headings that fail to accurately capture Indigenous content. Data cleansing comes with the procedures of detecting and eliminating duplicate records, correcting keyboard errors, and normalizing metadata fields to affect consistency. Secondly, culturally insensitive or irrelevant descriptions are identified and reviewed in collaboration with Indigenous knowledge keepers. Preprocessing with caution in this manner guarantees that the data are noise-free and distortion-free, and AI systems can perform effectively in identifying patterns of exclusion and misclassification. Normalized and cleaned data provides a basis for constructing classification systems that are representative of Indigenous worldviews, and hence, transitions are facilitated from imposed structures to culturally embedded knowledge representation.

- *Z-Score Normalization:*

Z-score normalization is the process of transforming any output descriptors into the normalized counterparts by computing the normalized mean and standard deviation for each parameter over several IKS management in library classification. A mean and standard deviation are provided for each characteristic. The following are the replacement details provided by generalized equation (1):

$$c' = \frac{c - \mu_Y}{\sigma_Y} \qquad (1)$$

Where the standard deviation of the attribute is denoted by σ_Y and a consequence, there is no volatility and no significance for any characteristic in the IKS management in library classification. Each training sample in the data set is initially placed through the Z-Score normalization procedure before creating a trainee collection and beginning the training approach, which were determined in the IKS management of library classification.

- *Removal of Duplicate:*

To offer accuracy, relevance, and integrity while remapping IKS, duplicate record elimination is required as part of the data pretreatment process for decolonizing knowledge organization. Duplicate data can distort the representation of Indigenous objects and the frequency of colonial classification. With the use of clean data, AI models can more accurately identify and reclassify materials, paving the path for the development of more polite and inclusive library classification system.

Feature Extraction

The application of TF-IDF and word embedding allowed for more accurate and respectful integration of IKS management into library classification by identifying cultural misclassifications through the derivation of relevant patterns from library information.

- *TF-IDF:*

TF-IDF is an influential computer technique applicable for determining the significance and assessment of IKS management in library classification in particular words with a given document about a vast number of records. In information retrieval and text mining in particular, it converts the raw text to direct numerical features for machine learning algorithms. *TF* Stands for Term Frequency which informs how often a particular word appears in an IKS management in library classification, whereas *IDF* stands for Inverse Document Frequency, which informs the uniqueness of the term with a corpus, as shown in equation (2),

$$TF - IDF\ (t, d, D) = TF\ (t, d) * IDF\ (t, D) \qquad (2)$$

Where $TF\ (t, d)$ shows the term frequency of term t in document d $IDF\ (t, d, D)$ Is the inverse document frequency of term t across the corpus D

- *Word Embedding:*

In the context of decolonizing knowledge organization, word embedding was employed as a feature extraction technique to capture semantic patterns with metadata and descriptions of library records. Unlike traditional keyword matching, word embedding enables deeper contextual understanding by representing words in multi-dimensional space based on relationships and usage in text. This approach allows the system to recognize culturally significant terms, detect colonial biases, and identify misclassifications.

Indigenous Knowledge Systems in Library Classification using MMBO-BERT

BERT and MMBO are used to support library classification. By converting Indigenous knowledge items into culturally relevant taxonomies, it accurately classifies and reclassifies. It decolonizes library systems using AI-driven, context-sensitive classification.

- *BERT:*

BERT is the capacity to read a text both forward and backward while comprehending the context and meaning of the words that make up a sentence. Indigenous Knowledge Systems use BERT in library classification to comprehend the rich linguistic and cultural expressions that are outside the scope of other standard models. BERT improves classification accuracy and makes it easier to find misclassified things by capturing conceptuality and relational meanings through indigenous-related information and descriptions. A classification method that is more considerate

to Indigenous worldviews, oral traditions, and knowledge systems is made possible by BERT's capacity to understand intricate linguistic patterns.

- *MMBO:*

MMBO algorithm with an emphasis on its later phases: population creation, neighbor solution generation, flapping, and leadership replacement. At every stage of the adaptive IKS management modeling framework, the main goal is to decolonize the library classification. The flowchart emphasizes cultural sensitivity, inclusive knowledge architectures, and dynamic reorganization.

Initial Population

A vast search space is produced by avoiding an early convergence of the MMBO algorithm, which simulates natural migration patterns. It was easy to spot incorrectly classified objects and provide class recommendations that respect IKS. The collection of diverse possible reclassification techniques to be used in library records created with metadata attributes, such as subject terms, descriptions, and classification topics makes up the first population for the MMBO model. To experiment with various culturally specific locations of Indigenous knowledge, as demonstrated by the equation (3), such candidates for the decolonization of knowledge structures are generated via Indigenous taxonomies and worldviews.

$$st_j = \begin{cases} if\ there\ is\ a\ permanent\ facility\ \ 2 \\ else\ \ \ \ \ \ \ 1 \end{cases} \quad (3)$$

Neighbor solution generation by replicating adaptive bird flying, neighbor solution generation in MMBO looks for subtleties among potential candidates to enable adaptive solution trajectory remolding. This kind of approach is particularly pertinent to the decolonization of library classification systems since IKS management is ignored by rigid Eurocentric taxonomy. Innovative merging of native relational patterns into classificatory structures is made possible by MMBO's adaptive neighbor solution feature. By using recursive reconstruction and dynamic re-categorization, MMBO honors indigenous peoples' worldviews rather than forcing IKS management into inflexible categories. Iteratively unrolling neighbor solutions in time is one computational method for exposing colonial hierarchies present in legacy library schemas and demonstrating the contextual and communal elements of IKS. This synthesis encourages methods of knowledge organization that are inclusive and sensitive to cultural differences, as shown in the equations (4) to (6).

$$d \epsilon \mathbb{N}^+; \quad l = 2d + 1 \quad (4)$$

$$1 \le w \le \left(\frac{l-1}{2}\right) \quad (5)$$

$$c = l - w \quad (6)$$

Flapping and Leader Change

When extended to decolonizing knowledge organization, these processes metaphorically describe incorporating IKS management into mainstream library classification. Flapping metaphorically represents the open-ended, non-hierarchical organization of IKS management knowledge as holistic, relational, and place-based in contrast to linear taxonomies. Leader change reflects changing from colonial patriarchy to Indigenous epistemologies guiding the process of classification. This dynamic is reflective of the way Indigenous voices can lead the transformation of metadata, categories, and hierarchies in libraries. By infusing MMBO's adaptive behaviors, libraries can mimic the changing, participatory nature of Indigenous knowledge so that classifications are not only inclusive but also respectful of sovereignty, oral traditions, and context-specific meaning systems. In this way, MMBO facilitates transformative, equitable knowledge ecology. Fig.2 shows the flowchart of MMBO.
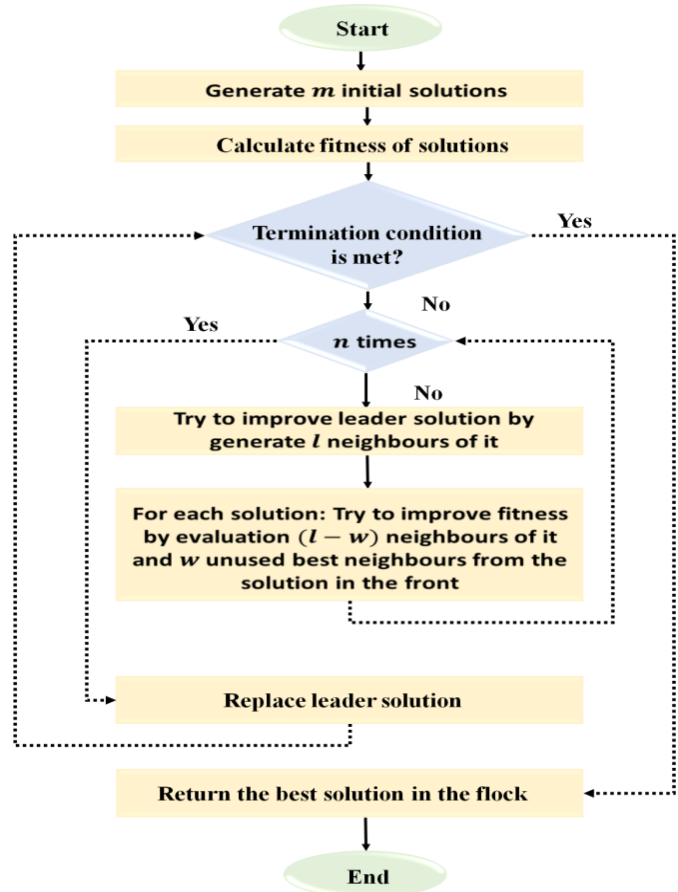

Fig. 2 Flowchart of MMBO

By interpreting Indigenous metadata's cultural and contextual nuances, BERT enhances library classification and facilitates accurate categorization. By simulating bird migration patterns, MMBO dynamically rearranges library records in compliance with IKS. It makes use of practices like leader replacement and flapping to promote inclusive, flexible, and decolonized classification that reflects Indigenous perspectives.

IV. RESULT

The Python platform and the RAM of a laptop with 8.00 GB are used to access data quickly. Intel® Core i9 Processors and Windows 11 have been utilized. The research proposed an MMBO-BERT, which responds to the colonial bias with conventional library classification systems that frequently misrepresent IKS. It investigates incorporating Indigenous worldviews through AI-powered tools. The goal is to develop a more inclusive, culturally sensitive knowledge organization framework.

- *Misclassification Detection Accuracy*

To assess the misclassification detection accuracy, the research classified the performance metrics such as accuracy, precision, recall, and F1-Score. When assessing a system's ability to identify and correct incorrectly classified data, misclassification detection accuracy is a crucial measure. It lacks cultural sensitivity and semantic awareness, and the accuracy of misclassification detection in traditional classification systems, especially those based on cataloging practices, remains low, especially for Indigenous knowledge. In contrast to these traditional techniques, the new MMBO-BERT method uses the MMBO algorithm and BERT's deep contextual awareness to greatly improve detection accuracy. This integrated model correctly distinguishes subtle cultural meanings and consistently identifies instances of misclassification. By integrating Indigenous knowledge frameworks into the classification process, MMBO-BERT offers more representative and accurate material classification, improving overall system reliability, as shown in TABLE I and Fig. 3.

TABLE I QUANTITATIVE VALUES OF MISCLASSIFICATION DETECTION ACCURACY

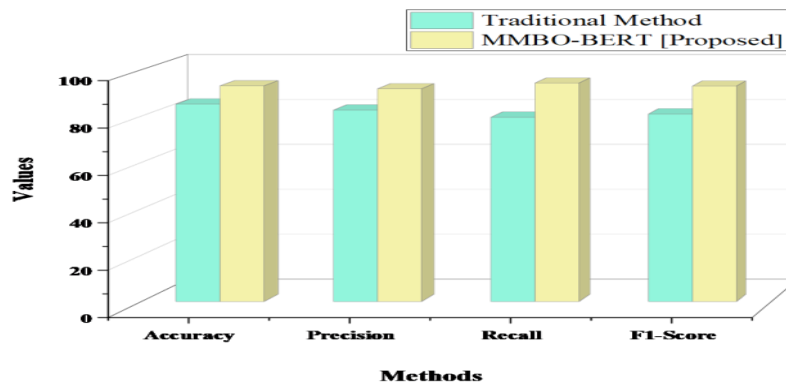| Methods	Accuracy (%)	Precision (%)	Recall (%)	F1-Score (%)
Traditional Method	85.2	82.6	79.5	80.9
MMBO-BERT [Proposed]	93.1	91.8	94.3	93.0

Fig. 3 Graphical Representation of Misclassification Detection Accuracy

- *Reclassification Recommendations*

Reclassifying IKS management should be given priority through community-led frameworks in an attempt to promote cultural accuracy and representation in TABLE II and Fig. 4. Reclassification using Cohen's Kappa in the indigenous taxonomies is proposed by the MMBO-BERT model, which also makes automated identification of misclassified content easier. To ensure that thematic categories reflect cultural practices, Indigenous knowledge holders can be involved. To guarantee effective representation, metadata can be enhanced with culturally appropriate descriptors. Long-term relevance, accuracy, and cultural sensitivity in library and archival databases can be preserved through regular audits and updates to classification systems, guided by AI insights and community input.

TABLE II QUANTITATIVE VALUES OF RECLASSIFICATION RECOMMENDATIONS

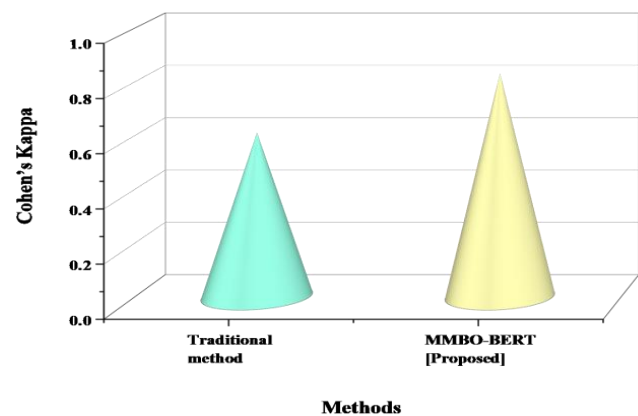| Methods	Cohen's Kappa (κ)
Traditional Method	0.61
MMBO-BERT [Proposed]	0.83

Fig. 4 Graphical Representation of Reclassification Recommendations

- *Confusion Matrix*

The confusion matrix displays 53 true positives and 47 true negatives, indicating error-free classification performance. The outcome demonstrates how well the model detects and categorizes records, which is essential for decolonizing

knowledge organization, as shown in Fig.5. Culturally sensitive classification is used to identify and preserve IKS management using advanced models like BERT and MMBO. By enhancing metadata understanding, these methods enable adaptive classification in line with Indigenous worldviews.

As part of the process to ensure equity and inclusivity in library systems and digital knowledge repositories, IKS management and voices are not misrepresented or marginalized but rather are encouraged.
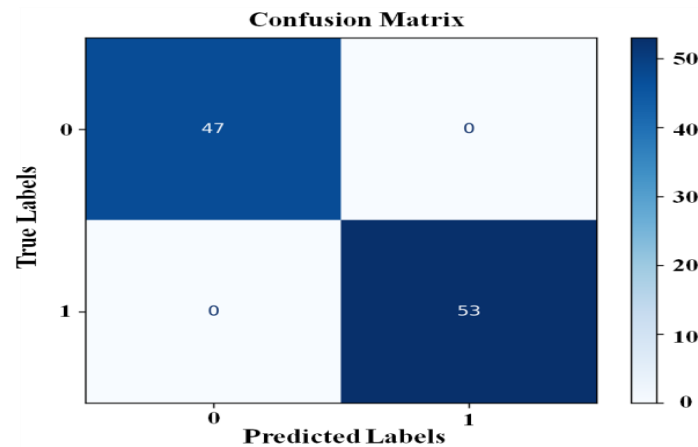

Fig. 5 Presentation of the Confusion Matrix

- *Description length vs. Misclassification Detection*

The relationship between description length and classification accuracy is depicted in Fig.6. Remarkably, the median lengths of correctly and wrongly categorized objects are similar, indicating that misclassification is not solely due to brevity. This suggests that culturally grounded models that go beyond surface metadata are essential in the context of the Decolonizing Knowledge Organization scenario. Rich contextual implications that are not covered by conventional descriptions are commonly seen in IKS. Rich knowledge is ensured and misclassification is reduced by incorporating IKS-sensitive algorithms. By respecting Indigenous epistemologies, this methodology enables library and archival systems to have more accurate, inclusive, and culturally sensitive classification schemes.

legitimacy, decolonizing knowledge organization necessitates considering IKS management to be equally legitimate and authoritative. Indigenous perspectives are typically overlooked in traditional expert evaluations due to differences in epistemologies. To address this imbalance, libraries can implement inclusive classification methods that incorporate oral tradition and community-based verification. Apostrophizing IKS management challenges colonial hierarchies that are ingrained in current systems and reworks knowledge structure and access. It encourages knowledge sovereignty, representative justice, and cultural sensitivity in library classification schemes.

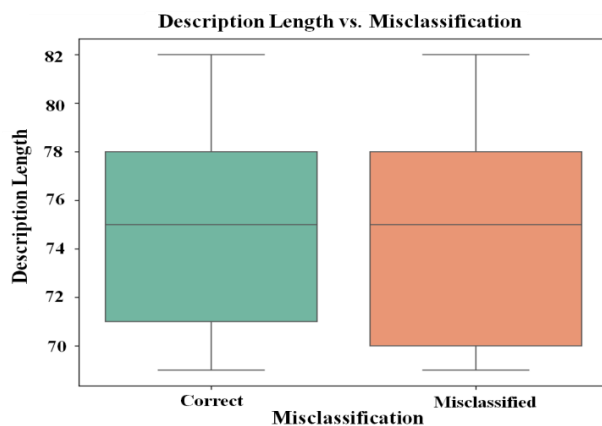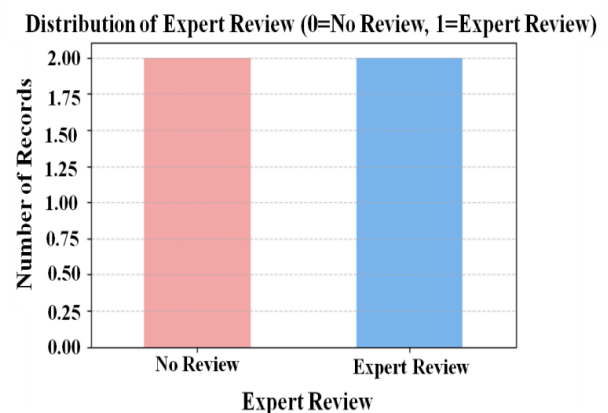Fig. 7 Presentation of Expert Review

Fig. 6 Presentation of Misclassification Detection

- *Distribution of Expert Review*

The proportion of records with and without expert evaluation is equal, as seen in Fig. 7. Although expert evaluation adds

- *Assessing Comparative Evaluation*

Fig.8 demonstrates a comparative analysis of traditional, BERT, and MMBO-BERT systems in classifying knowledge. To decolonize knowledge organization, IKS management needs models that have high cultural sensitivity, context awareness, and capacity to accommodate indigenous taxonomies. MMBO-BERT is always superior to traditional systems in these capacities, suggesting the ability to sustain

inclusive and respectful classification frameworks. In contrast to more traditional methods that perform poorly on Indigenous adaptability, sophisticated models, such as MMBO-BERT can incorporate culturally responsive words without the need for expert mediation. To decolonize library practices that reinforce Indigenous epistemologies and support balanced knowledge representation.
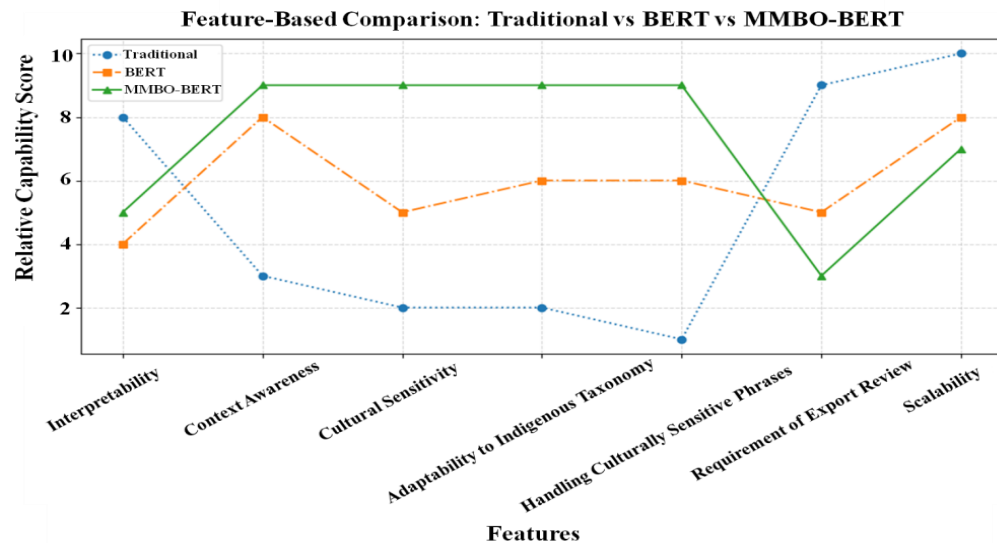

Fig. 8 Presentation of Comparative Evaluation

V. DISCUSSION

The incorporation of IKS management into standard library classification requires technical improvement that go beyond cultural sensitivity, community representation, and semantic richness. The classical approach to classification tends to be account to contextual and cultural subtlety, leading to the misclassification and marginalization of Indigenous knowledge. By comparison, sophisticated AI models, such as MMBO-BERT, which leverages the deep contextual capacity of BERT with the adaptive optimization of the MMBO, provide a revolutionary solution. Such models transcend surface metadata, grasping nuanced cultural meaning and native taxonomies better. Through culturally sensitive automation of reclassification and the integration of Indigenous knowledge keepers in decision-making over classification, MMBO-BERT not only remediates current misrepresentations but also promotes impartial knowledge structures.

VI. CONCLUSION

The research emphasizes how crucial culturally aware AI models are to decolonizing structural knowledge for IKS. Due to a lack of cultural sensitivity, semantic inadequacy, and insufficient flexibility to take into account indigenous taxonomies, indigenous classification systems misclassify and diminish. By combining the MMBO algorithm with BERT's profound contextual awareness, the suggested MMBO-BERT model shows a noticeable improvement in misclassification detection, reclassification accuracy, and confusion matrix performance. The MMBO-BERT methodology performed better in Accuracy at (93.1%), Precision at (91.8%), Recall at (94.3%), F1-Score at (93.0%), and Cohen's Kappa at (0.83). Furthermore, it demonstrates a high degree of convergence with community-based classification standards and little dependence on traditional expert knowledge. The MMBO-BERT improves inclusive and representative knowledge systems by incorporating Indigenous knowledge and cultural distinctiveness into classification procedures. Quantitative results and perceptual comparisons demonstrate that MMBO-BERT improves performance and takes epistemic variation into account. For long-term, ethically sound systematizations that recognize, validate, and integrate Indigenous voices in global knowledge systems, this technique ultimately promotes access to library and archive databases and knowledge sovereignty.

REFERENCES

[1] Alhassan, S., Abdul-Salaam, G., Micheal, A., Missah, Y. M., Ganaa, E. D., & Shirazu, A. S. (2024). CFS-AE: Correlation-based Feature Selection and Autoencoder for Improved Intrusion Detection System Performance. *Journal of Interne Services and Information Security, 14*(1), 104-120. https://doi.org/10.58346/JISIS.2024.I1.007

[2] Ali, T., Buergelt, P. T., Maypilama, E. L., Paton, D., Smith, J. A., & Jehan, N. (2022). The synergy of systems theory and symbolic interactionism: a passageway for non-Indigenous researchers that facilitates better understanding Indigenous worldviews and knowledge. *International Journal of Social Research Methodology, 25*(2), 197-212. https://doi.org/10.1080/13645579.2021.1876300

[3] Azoury, N., Subrahmanyam, S., & Sarkis, N. (2024). The Influence of a Data-Driven Culture on Product Development and Organizational Success through the Use of Business Analytics. *Journal of Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications, 15*(2), 123-134. https://doi.org/10.58346/JOWUA.2024.I2.009

[4] Biswas, D., & Tiwari, A. (2024). Utilizing Computer Vision and Deep Learning to Detect and Monitor Insects in Real Time by Analyzing Camera Trap Images. *Natural and Engineering Sciences, 9*(2), 280-292. https://doi.org/10.28978/nesciences.1575480

[5] Bocking, S. (2023). Indigenous knowledge and perspectives. In *Handbook of the historiography of the earth and environmental sciences* (pp. 1-24). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-92679-3_20-1

[6] Burgess, C., Bishop, M., & Lowe, K. (2022). Decolonising Indigenous education: the case for cultural mentoring in supporting Indigenous knowledge reproduction. *Discourse: Studies in the Cultural Politics of Education, 43*(1), 1-14. https://doi.org/10.1080/01596306.2020.1774513

[7] Bwambale, B., Nyeko, M., Sekajugo, J., & Kervyn, M. (2022). The essential contribution of indigenous knowledge to understanding natural hazards and disaster risk: historical evidence from the Rwenzori (Uganda). *Natural Hazards*, *110*(3), 1847-1867. https://doi.org/10.1007/s11069-021-05015-x

[8] Das, J. (2025). Indigenous knowledge and sustainable development: Rüza—A traditional water management practice in Phek district, Nagaland. *Sustainable Development, 33*(1), 349-363. https://doi.org/10.1002/sd.3104

[9] Deen, C., Sherriff, S., Shelling, M., Gall, A., Cubillo, B., Te Morenga, L., ... & Matthews, V. (2025). Measuring Indigenous food security—A case for Indigenous designed tools. *Health Promotion Journal of Australia, 36*(1), e945. https://doi.org/10.1002/hpja.945

[10] Fa, J. E., & Luiselli, L. (2025). Weaving the Middle Spaces Between Indigenous and Scientific Knowledge for Biodiversity Conservation and Ecology. *African Journal of Ecology, 63*(2), e70030. https://doi.org/10.1111/aje.70030

[11] Fisk, J. J., Leong, K. M., Berl, R. E., Long, J. W., Landon, A. C., Adams, M. M., ... & Salerno, J. (2024). Evolving wildlife management cultures of governance through Indigenous Knowledges and perspectives. *The Journal of Wildlife Management, 88(*6), e22584. https://doi.org/10.1002/jwmg.22584

[12] Frid, A., Wilson, K. L., Walkus, J., Forrest, R. E., & Reid, M. (2023). Re-imagining the precautionary approach to make collaborative fisheries management inclusive of Indigenous Knowledge Systems. *Fish and Fisheries, 24*(6), 940-958. https://doi.org/10.1111/faf.12778

[13] Gazing Wolf, J., Ignace, D. D., David-Chavez, D. M., Jennings, L. L., Smiles, D., Blanchard, P., ... & Rattling Leaf, J. (2024). Centering Indigenous Knowledges in ecology and beyond. *Frontiers in Ecology and the Environment*. https://doi.org/10.1002/fee.2776

[14] Isaac, G., Burgio-Ericson, K., McChesney, L., Green, A. G., Charley, K. K., Church, K., & Dillard, R. W. (2025). Making kin is more than a metaphor: Implications of responsibilities toward Indigenous knowledge and artistic traditions for museums. *Museum Anthropology, 48*(1), e12283. https://doi.org/10.1111/muan.12283

[15] Jessen, T. D., Ban, N. C., Claxton, N. X., & Darimont, C. T. (2022). Contributions of Indigenous Knowledge to ecological and evolutionary understanding. *Frontiers in Ecology and the Environment, 20*(2), 93-101. https://doi.org/10.1002/fee.2435

[16] Kumar, N., Navetha, Priyadharshini, Srisaran, & Singaravel. (2022). Knowledge based Approach to Detect Potentially Risky Websites. *International Journal of Advances in Engineering and Emerging Technology, 13*(2), 1–10

[17] Liew, C. L., Yeates, J., & Lilley, S. C. (2021). Digitized indigenous knowledge collections: Impact on cultural knowledge transmission, social connections, and cultural identity. *Journal of the Association for Information Science and Technology, 72*(12), 1575-1592. https://doi.org/10.1002/asi.24536

[18] Nwosu, P. O., & Adeloye, F. C. (2023). Transformation Leader Strategies for Successful Digital Adaptation. *Global Perspectives in Management*, *1*(1), 1-16.

[19] Odora Hoppers, C. (2021). Research on Indigenous knowledge systems: The search for cognitive justice. *International Journal of Lifelong Education, 40*(4), 310-327. https://doi.org/10.1080/02601370.2021.1966109

[20] Owolabi, K. A., Ovwasa, D. E., Ajayi, T. B., & Odewale, M. O. (2022). Preservation and use of indigenous knowledge practices in public libraries in Nigeria. *Public Library Quarterly*, *41*(5), 485-502. https://doi.org/10.1080/01616846.2021.1938897

[21] Padhye, I., & Shrivastav, P. (2024). The Role of Pharmacists in Optimizing Medication Regimens for Patients with Polypharmacy. *Clinical Journal for Medicine, Health and Pharmacy*, *2*(2), 41-50.

[22] Prest, A., Goble, J. S., Vazquez-Cordoba, H., & Tuinstra, B. (2021). Enacting curriculum 'in a good way:'Indigenous knowledge, pedagogy, and worldviews in British Columbia music education classes. *Journal of Curriculum Studies, 53*(5), 711-728. https://doi.org/10.1080/00220272.2021.1890836

[23] Turner, N. J., & Reid, A. J. (2022). "When the wild roses bloom": Indigenous knowledge and environmental change in northwestern North America. *GeoHealth, 6*(11), e2022GH000612. https://doi.org/10.1029/2022GH000612

[24] Yabang, W., Manning, E. E., Mate, K. E., Endacott, S. K., & Cameron, G. J. (2025). Indigenous student engagement in science: case research addressing the lack of diversity and equity in biomedical science and pharmacy research for Aboriginal and Torres Strait Islander people. *Immunology and Cell Biology*. https://doi.org/10.22541/au.173346352.22452098/v1

[25] Zahedifard, M., Attarzadeh, I., Pazhokhzadeh, H., & Malekzadeh, J. (2015). Prediction of students' performance in high school by data mining classification techniques. *International Academic Journal of Science and Engineering, 2*(1), 139–147. https://doi.org/10.1002/jwmg.2258