AI-Driven Demand-Oriented STEM Education Strategy for Our Muslim Community

Yan Sha
University of Alberta
ysha3@ualberta.ca

Zhao Dong
School of Mathematics and Physics
Hebei University of Engineering
dongzhao@hebeu.edu.cn

Shaokai Yang
Department of Physics
University of Alberta
shaokai1@ualberta.ca

Abstract

In the context of rapidly advancing global technology, Science, Technology, Engineering, and Mathematics (STEM) education in the Middle East and Muslim-majority regions is essential for driving innovation and supporting economic diversification. But, significant gaps remain between current educational practices and our vision, particularly in learning methodologies, student motivation, employment market alignment, and educational equity. We propose a comprehensive strategic framework that leverages large language models (LLMs) and virtual reality (VR) to create an AI-supported, closed-loop skills training system offering immersive and personalized learning experiences. Additionally, it promotes a mutually beneficial, cross-regional educational cooperation model that fosters resource sharing between economically developed and underdeveloped areas to support the development of Muslim communities around the world. This framework aims to establish an inclusive and efficient global STEM education system within Muslim communities, empowering the younger generation to meet future challenges while ensuring sustainable returns for sponsors in cultivating global tech talent.

1 Introduction

STEM education in the global Muslim community is tasked with enhancing innovation capacity, cultivating globally competitive talent, and supporting economic diversification. But, gaps between educational content and practical needs, limited adaptability of curricula to cultural contexts, and imbalanced resource allocation hinder the achievement of these goals. We propose a multifaceted strategic approach to bridge the gap between existing educational systems and the region's economic and social vision, as shown in figure 1. Key strategies include the introduction of LLMs trained in specialized fields to enable dynamic integration of cross-disciplinary knowledge, creating an education system that meets contemporary demands; utilizing VR-driven experiential learning to enhance students' practical skills and engagement; establishing an AI-supported, closed-loop training system to align skill development precisely with job market needs; and fostering a mutually beneficial, cross-regional educational cooperation model to facilitate resource sharing and talent cultivation within Muslim communities, promoting collaboration between economically developed and underdeveloped areas. This framework aims to integrate innovative technology and educational resources to help Muslim regions address the dual challenges of educational and economic transformation [1].

2 LLM-Driven Education: Interdisciplinary Collaboration and Resource Equity

With the advancement of AI, the potential of LLMs in education is gradually emerging. Through the dynamic integration of knowledge across various fields, intelligent adaptive learning features,

38th Conference on Neural Information Processing Systems (NeurIPS 2024).

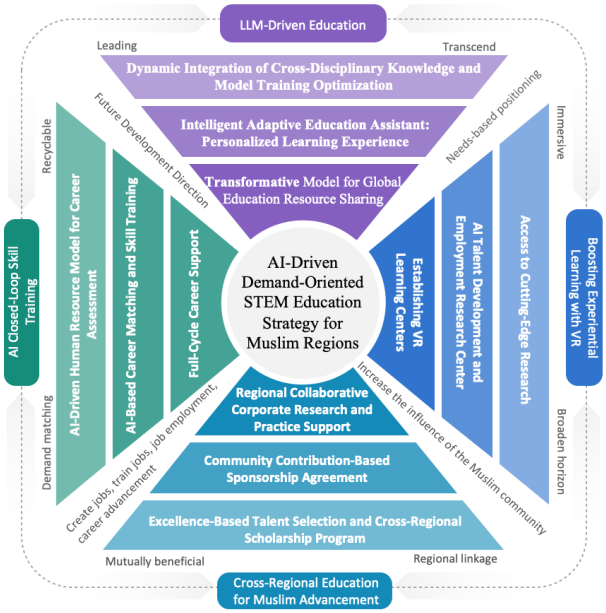

Figure 1: AI-Driven Demand-Oriented STEM Education Strategic Framework for Muslim Regions

and transformative solutions for global educational resource sharing, LLMs offer new pathways to address educational challenges [2].

2.1 Dynamic Integration of Cross-Disciplinary Knowledge and Model Training Optimization

The effectiveness of LLMs lies in their breadth of knowledge and timely updates. To ensure high reliability, experts from various fields continuously update the model's knowledge base to incorporate the latest advancements in areas such as physics, artificial intelligence, and medicine. This comprehensive training process not only enhances the precision of knowledge output but also promotes a more balanced distribution of educational resources, breaking the regional limitations of subject-specific resources.

2.2 Intelligent Adaptive Education Assistant: Personalized Learning Experience

LLMs possess adaptive capabilities that allow them to adjust content and difficulty levels in real-time based on learner feedback, providing personalized learning support. The model can generate multi-level knowledge modules to meet the needs of students at different learning levels. This intelligent adaptability not only facilitates individualized learning but also compensates for traditional education's limitations in personalization, thereby enhancing students' learning engagement [3].

2.3 Global Education Resource Sharing: A New Direction

Although the application of LLMs in education is still in its experimental stages, their potential to address global educational inequalities and delays in knowledge updates is increasingly evident. As a forward-looking educational tool, LLMs offer innovative solutions for global education. Developed nations are piloting these models in classroom teaching and personalized learning to enhance interactivity and efficiency, as shown in figure 2, while in regions with limited educational resources, the model provides an alternative learning support. Studies suggest that this approach will significantly improve global educational accessibility, heralding profound changes in the global education system.

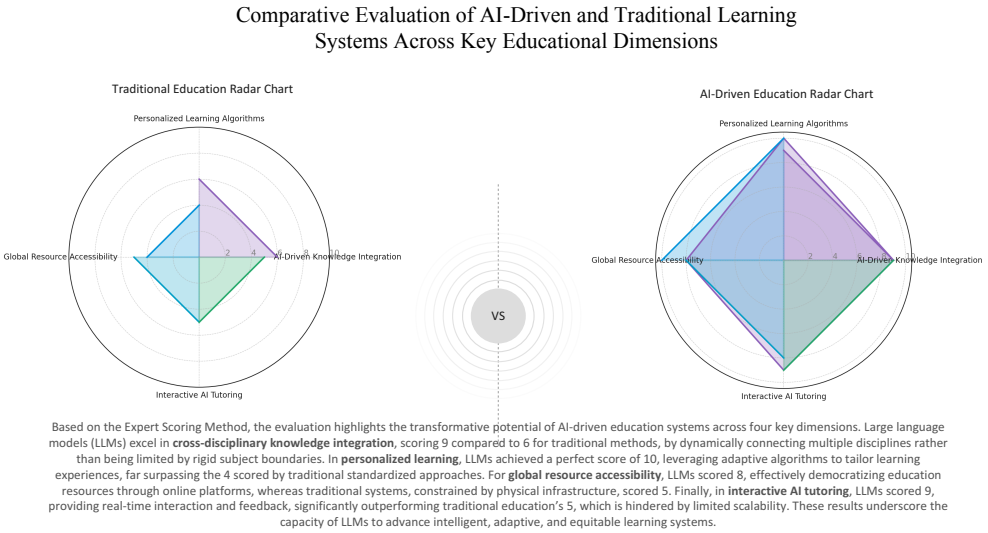

Figure 2: Comparison of AI-Driven and Traditional Learning Systems in Key Educational Dimensions

3 Enhancing Experiential Learning through Virtual Reality

VR technology has brought innovation to education by offering students immersive learning experiences, allowing them to gain a deep understanding of practical applications within STEM fields. The application of VR not only sparks students' interest in learning but also enables them to explore complex scientific concepts within a virtual environment, laying a solid foundation for their future career development.

3.1 Access to Cutting-Edge Research

Through VR simulations, students can virtually visit international research laboratories, explore space, or participate in biomedical experiments. These experiences help students understand the societal impact of science and technology, increase their motivation to learn, and inspire them to explore STEM-related careers [4-5].

3.2 Establishing VR Learning Centers

Educational institutions in the Muslim countires can collaborate with government and industry to establish VR learning centers. These centers not only provide academic knowledge but also integrate practical experience into immersive courses, offering a replicable model for advancing regional STEM education.

3.3 AI Talent Development and Employment Research Center

Through a dedicated AI research center, career pathways can be analyzed and aligned with industry needs. This center sets specific development goals and designs targeted training programs to prepare students for real job opportunities, creating a seamless "learning-to-employment" pathway. The curriculum is closely aligned with labor market demands and integrates feedback from both government and industry.

4 AI-Based Closed-Loop Training System for Skill Matching

The disconnect between education and labor market demands is a key challenge in talent development. The AI-supported closed-loop training system uses intelligent assessment and skill matching to ensure that students acquire practical skills that are directly applicable to the job market.

4.1 AI-Driven Human Resource Model for Career Assessment

The AI system conducts a comprehensive assessment of students based on behavioral traits and cognitive abilities to understand their skills and career inclinations. Through big data analysis, AI can create personalized training plans that align students' potential with specific career roles, thereby enhancing the effectiveness of education and increasing employment success rates.

4.2 AI-Based Career Matching and Skill Training

After assessing students' career directions, the AI system matches them with specific training programs to help them acquire skills directly required by the job market. Additionally, the AI dynamically adjusts training content based on feedback to ensure that the curriculum aligns with industry needs. Graduates can also receive job matching, mentorship, and career development advice through the AI system, facilitating a smooth transition from learning to employment.

4.3 Full-Cycle Career Support

The AI system provides students with full-cycle support from initial training to career development. By continuously monitoring learning and job performance, the AI can recommend additional skill training and advancement opportunities, helping students adapt to the work environment and gradually build career confidence, laying the foundation for further professional growth.

5 Mutually Beneficial Educational Collaboration Model for Muslim Communities

Promoting educational resource sharing and cultivating local high-skilled talent are key to enhancing the overall competitiveness of the Muslim community. Through cross-regional collaboration, research institutions and high-tech enterprises from economically developed countries can support underdeveloped regions, while building global technology and talent reserves to achieve mutual benefits in education and economic growth.

5.1 Excellence-Based Talent Selection and Cross-Regional Scholarship Program

Establish scholarships funded by research institutions or enterprises from developed countries to select outstanding students from underdeveloped regions within Muslim communities for admission to top universities. This not only cultivates future tech talent but also helps sponsors attract high-potential international talent and strengthen global R&D teams.

5.2 Community Contribution-Based Sponsorship Agreement

Through a contribution-based sponsorship agreement, sponsored students are required to serve the Muslim community for a certain number of years upon completing their studies. This ensures that the educational investment translates into long-term development for the community and provides sponsors with a foundation for expanding their business and influence in local markets, fostering a sustainable and mutually beneficial partnership.

5.3 Regional Collaborative Corporate Research and Practice Support

Encourage high-tech companies to collaborate with universities and research institutions in the Muslim community to establish cross-border research internships and training programs. Participating companies can not only cultivate technical talent that meets their needs but also expand their business and brand influence in Muslim markets, laying a solid foundation for global outreach.

References

[1] Zhao, Q.P. (2020) Integration and application of virtual reality and artificial intelligence in education. In *VR+AI: The Potential Ultimate Educational Technology*. Beijing, China: Institute of Smart Learning, Beijing Normal University.

[2] School of Information Science and Technology, Beijing Normal University (2020) Artificial intelligence in personalized STEM education. In *Research on AI Application in Personalized STEM Education*. Beijing, China: China Educational Informatization.

[3] Wang, Y.F. (2024) The strategic value of large scientific facilities and their position in the science and technology innovation system. In *Science and Technology Daily*. Beijing, China: Science and Technology Daily Press.

[4] Khan, A.S. (2023) The strategic role of big science in national development. In *Journal of Science Policy*. Cambridge, MA: Elsevier.

[5] UNESCO (2022) Research and development in the Arab states. In *UNESCO Report*. Paris, France: UNESCO Publishing.

NeurIPS Paper Checklist

1. **Claims**

   Question: Do the main claims made in the abstract and introduction accurately reflect the paper's contributions and scope?

   Answer: [Yes] ,

   Justification: The claims in the abstract and introduction accurately reflect the contributions of the paper, specifically highlighting the novel application of deep learning models in the analysis of biophysics data.

   Guidelines:

   - The answer NA means that the abstract and introduction do not include the claims made in the paper.
   - The abstract and/or introduction should clearly state the claims made, including the contributions made in the paper and important assumptions and limitations. A No or NA answer to this question will not be perceived well by the reviewers.
   - The claims made should match theoretical and experimental results, and reflect how much the results can be expected to generalize to other settings.
   - It is fine to include aspirational goals as motivation as long as it is clear that these goals are not attained by the paper.

2. **Limitations**

   Question: Does the paper discuss the limitations of the work performed by the authors?

   Answer: [Yes]

   Justification:The paper includes a dedicated section on limitations (Section 4). We address the limitations related to the generalizability of our approach, as the results have been validated on a limited number of datasets.

   Guidelines:

   - The answer NA means that the paper has no limitation while the answer No means that the paper has limitations, but those are not discussed in the paper.
   - The authors are encouraged to create a separate "Limitations" section in their paper.
   - The paper should point out any strong assumptions and how robust the results are to violations of these assumptions (e.g., independence assumptions, noiseless settings, model well-specification, asymptotic approximations only holding locally). The authors should reflect on how these assumptions might be violated in practice and what the implications would be.
   - The authors should reflect on the scope of the claims made, e.g., if the approach was only tested on a few datasets or with a few runs. In general, empirical results often depend on implicit assumptions, which should be articulated.
   - The authors should reflect on the factors that influence the performance of the approach. For example, a facial recognition algorithm may perform poorly when image resolution is low or images are taken in low lighting. Or a speech-to-text system might not be used reliably to provide closed captions for online lectures because it fails to handle technical jargon.
   - The authors should discuss the computational efficiency of the proposed algorithms and how they scale with dataset size.
   - If applicable, the authors should discuss possible limitations of their approach to address problems of privacy and fairness.
   - While the authors might fear that complete honesty about limitations might be used by reviewers as grounds for rejection, a worse outcome might be that reviewers discover limitations that aren't acknowledged in the paper. The authors should use their best judgment and recognize that individual actions in favor of transparency play an important role in developing norms that preserve the integrity of the community. Reviewers will be specifically instructed to not penalize honesty concerning limitations.

3. **Theory Assumptions and Proofs**

Question: For each theoretical result, does the paper provide the full set of assumptions and a complete (and correct) proof?

Answer: [NA]

Justification: This paper focuses on the application of deep learning models for 3D reconstruction and does not introduce any new theoretical results that require formal proofs. The methods and algorithms used are based on existing techniques, which are referenced appropriately.

Guidelines:

- The answer NA means that the paper does not include theoretical results.
- All the theorems, formulas, and proofs in the paper should be numbered and cross-referenced.
- All assumptions should be clearly stated or referenced in the statement of any theorems.
- The proofs can either appear in the main paper or the supplemental material, but if they appear in the supplemental material, the authors are encouraged to provide a short proof sketch to provide intuition.
- Inversely, any informal proof provided in the core of the paper should be complemented by formal proofs provided in appendix or supplemental material.
- Theorems and Lemmas that the proof relies upon should be properly referenced.

4. **Experimental Result Reproducibility**

Question: Does the paper fully disclose all the information needed to reproduce the main experimental results of the paper to the extent that it affects the main claims and/or conclusions of the paper (regardless of whether the code and data are provided or not)?

Answer: [Yes]

Justification: The paper provides detailed descriptions of the experimental setup, data acquisition methods, and model architectures, including the use of super-resolution and diffusion models. Additionally, all code, model training scripts, and datasets have been made available on GitHub (as mentioned in Section 3.3), allowing for full reproducibility of the results. Furthermore, the paper outlines the specific hardware and software configurations used for training.

Guidelines:

- The answer NA means that the paper does not include experiments.
- If the paper includes experiments, a No answer to this question will not be perceived well by the reviewers: Making the paper reproducible is important, regardless of whether the code and data are provided or not.
- If the contribution is a dataset and/or model, the authors should describe the steps taken to make their results reproducible or verifiable.
- Depending on the contribution, reproducibility can be accomplished in various ways. For example, if the contribution is a novel architecture, describing the architecture fully might suffice, or if the contribution is a specific model and empirical evaluation, it may be necessary to either make it possible for others to replicate the model with the same dataset, or provide access to the model. In general. releasing code and data is often one good way to accomplish this, but reproducibility can also be provided via detailed instructions for how to replicate the results, access to a hosted model (e.g., in the case of a large language model), releasing of a model checkpoint, or other means that are appropriate to the research performed.
- While NeurIPS does not require releasing code, the conference does require all submissions to provide some reasonable avenue for reproducibility, which may depend on the nature of the contribution. For example
  (a) If the contribution is primarily a new algorithm, the paper should make it clear how to reproduce that algorithm.
  (b) If the contribution is primarily a new model architecture, the paper should describe the architecture clearly and fully.

(c) If the contribution is a new model (e.g., a large language model), then there should either be a way to access this model for reproducing the results or a way to reproduce the model (e.g., with an open-source dataset or instructions for how to construct the dataset).

(d) We recognize that reproducibility may be tricky in some cases, in which case authors are welcome to describe the particular way they provide for reproducibility. In the case of closed-source models, it may be that access to the model is limited in some way (e.g., to registered users), but it should be possible for other researchers to have some path to reproducing or verifying the results.

5. **Open access to data and code**

Question: Does the paper provide open access to the data and code, with sufficient instructions to faithfully reproduce the main experimental results, as described in supplemental material?

Answer: [Yes]

Justification: The paper provides open access to both the code and datasets through a publicly accessible GitHub repository, as stated in Section 3.3. Detailed instructions are included for data access, environment setup, and running the code, ensuring that the experiments can be faithfully reproduced.

Guidelines:

- The answer NA means that paper does not include experiments requiring code.
- Please see the NeurIPS code and data submission guidelines (`https://nips.cc/public/guides/CodeSubmissionPolicy`) for more details.
- While we encourage the release of code and data, we understand that this might not be possible, so "No" is an acceptable answer. Papers cannot be rejected simply for not including code, unless this is central to the contribution (e.g., for a new open-source benchmark).
- The instructions should contain the exact command and environment needed to run to reproduce the results. See the NeurIPS code and data submission guidelines (`https://nips.cc/public/guides/CodeSubmissionPolicy`) for more details.
- The authors should provide instructions on data access and preparation, including how to access the raw data, preprocessed data, intermediate data, and generated data, etc.
- The authors should provide scripts to reproduce all experimental results for the new proposed method and baselines. If only a subset of experiments are reproducible, they should state which ones are omitted from the script and why.
- At submission time, to preserve anonymity, the authors should release anonymized versions (if applicable).
- Providing as much information as possible in supplemental material (appended to the paper) is recommended, but including URLs to data and code is permitted.

6. **Experimental Setting/Details**

Question: Does the paper specify all the training and test details (e.g., data splits, hyperparameters, how they were chosen, type of optimizer, etc.) necessary to understand the results?

Answer: [Yes]

Justification: The paper specifies the details of the experimental setup, including data acquisition, data splits, and model hyperparameters. The choice of optimizer and its configurations are also provided, ensuring that the experimental results can be fully understood. Further details are provided in the supplemental material and the accompanying GitHub repository (Section 2.1 and 2.2)."

Guidelines:

- The answer NA means that the paper does not include experiments.
- The experimental setting should be presented in the core of the paper to a level of detail that is necessary to appreciate the results and make sense of them.
- The full details can be provided either with the code, in appendix, or as supplemental material.

7. **Experiment Statistical Significance**

   Question: Does the paper report error bars suitably and correctly defined or other appropriate information about the statistical significance of the experiments?

   Answer: [No]

   Justification: The paper focuses on the qualitative performance of the Vision-Cell framework in sparse data environments and does not include statistical significance measures such as error bars. The experiments are designed to demonstrate the framework's ability to generate high-quality 3D reconstructions rather than to assess variability or uncertainty across multiple runs.

   Guidelines:

   - The answer NA means that the paper does not include experiments.
   - The authors should answer "Yes" if the results are accompanied by error bars, confidence intervals, or statistical significance tests, at least for the experiments that support the main claims of the paper.
   - The factors of variability that the error bars are capturing should be clearly stated (for example, train/test split, initialization, random drawing of some parameter, or overall run with given experimental conditions).
   - The method for calculating the error bars should be explained (closed form formula, call to a library function, bootstrap, etc.)
   - The assumptions made should be given (e.g., Normally distributed errors).
   - It should be clear whether the error bar is the standard deviation or the standard error of the mean.
   - It is OK to report 1-sigma error bars, but one should state it. The authors should preferably report a 2-sigma error bar than state that they have a 96% CI, if the hypothesis of Normality of errors is not verified.
   - For asymmetric distributions, the authors should be careful not to show in tables or figures symmetric error bars that would yield results that are out of range (e.g. negative error rates).
   - If error bars are reported in tables or plots, The authors should explain in the text how they were calculated and reference the corresponding figures or tables in the text.

8. **Experiments Compute Resources**

   Question: For each experiment, does the paper provide sufficient information on the computer resources (type of compute workers, memory, time of execution) needed to reproduce the experiments?

   Answer: [Yes]

   Justification: The paper specifies the type of compute resources used, including an RTX 4060 GPU and later two A100 GPUs for more complex model training. Memory limitations encountered with the RTX 4060 GPU are also discussed, along with the time required for training tasks. Further details, such as memory usage and time of execution, are provided in the supplemental material (see Section 4).

   Guidelines:

   - The answer NA means that the paper does not include experiments.
   - The paper should indicate the type of compute workers CPU or GPU, internal cluster, or cloud provider, including relevant memory and storage.
   - The paper should provide the amount of compute required for each of the individual experimental runs as well as estimate the total compute.
   - The paper should disclose whether the full research project required more compute than the experiments reported in the paper (e.g., preliminary or failed experiments that didn't make it into the paper).

9. **Code Of Ethics**

   Question: Does the research conducted in the paper conform, in every respect, with the NeurIPS Code of Ethics `https://neurips.cc/public/EthicsGuidelines`?

Answer: [Yes]

Justification: he research conducted in this paper fully conforms with the NeurIPS Code of Ethics. All experiments and data used in this study are from publicly available sources or obtained through ethical means, with no human or animal subjects involved. The paper adheres to the principles of transparency, fairness, and societal responsibility outlined in the Code of Ethics.

Guidelines:

- The answer NA means that the authors have not reviewed the NeurIPS Code of Ethics.
- If the authors answer No, they should explain the special circumstances that require a deviation from the Code of Ethics.
- The authors should make sure to preserve anonymity (e.g., if there is a special consideration due to laws or regulations in their jurisdiction).

10. **Broader Impacts**

Question: Does the paper discuss both potential positive societal impacts and negative societal impacts of the work performed?

Answer: [Yes]

Justification: The paper discusses the positive societal impacts of the Vision-Cell framework, particularly in its potential to advance biological and medical research by enabling high-precision 3D cell reconstructions with minimal physical damage to samples. This could lead to breakthroughs in fields such as neuroscience and structural biology. The paper also considers the broader implications of deep learning in biological research but does not foresee any direct negative societal impacts, as the work is foundational and not tied to applications with ethical risks.

Guidelines:

- The answer NA means that there is no societal impact of the work performed.
- If the authors answer NA or No, they should explain why their work has no societal impact or why the paper does not address societal impact.
- Examples of negative societal impacts include potential malicious or unintended uses (e.g., disinformation, generating fake profiles, surveillance), fairness considerations (e.g., deployment of technologies that could make decisions that unfairly impact specific groups), privacy considerations, and security considerations.
- The conference expects that many papers will be foundational research and not tied to particular applications, let alone deployments. However, if there is a direct path to any negative applications, the authors should point it out. For example, it is legitimate to point out that an improvement in the quality of generative models could be used to generate deepfakes for disinformation. On the other hand, it is not needed to point out that a generic algorithm for optimizing neural networks could enable people to train models that generate Deepfakes faster.
- The authors should consider possible harms that could arise when the technology is being used as intended and functioning correctly, harms that could arise when the technology is being used as intended but gives incorrect results, and harms following from (intentional or unintentional) misuse of the technology.
- If there are negative societal impacts, the authors could also discuss possible mitigation strategies (e.g., gated release of models, providing defenses in addition to attacks, mechanisms for monitoring misuse, mechanisms to monitor how a system learns from feedback over time, improving the efficiency and accessibility of ML).

11. **Safeguards**

Question: Does the paper describe safeguards that have been put in place for responsible release of data or models that have a high risk for misuse (e.g., pretrained language models, image generators, or scraped datasets)?

Answer: [NA]

Justification: The paper does not release any data or models that pose a high risk for misuse. The Vision-Cell framework focuses on biological data with no foreseeable ethical concerns

related to privacy, security, or malicious use. Therefore, no specific safeguards are necessary for the release of this work.

Guidelines:

- The answer NA means that the paper poses no such risks.
- Released models that have a high risk for misuse or dual-use should be released with necessary safeguards to allow for controlled use of the model, for example by requiring that users adhere to usage guidelines or restrictions to access the model or implementing safety filters.
- Datasets that have been scraped from the Internet could pose safety risks. The authors should describe how they avoided releasing unsafe images.
- We recognize that providing effective safeguards is challenging, and many papers do not require this, but we encourage authors to take this into account and make a best faith effort.

12. **Licenses for existing assets**

Question: Are the creators or original owners of assets (e.g., code, data, models), used in the paper, properly credited and are the license and terms of use explicitly mentioned and properly respected?

Answer: [Yes]

Justification: The paper uses publicly available datasets and models, all of which are properly credited in the references section. We have explicitly mentioned the license and terms of use for these assets where applicable (see Section X for details), and no scraped data from restricted sources were used

Guidelines:

- The answer NA means that the paper does not use existing assets.
- The authors should cite the original paper that produced the code package or dataset.
- The authors should state which version of the asset is used and, if possible, include a URL.
- The name of the license (e.g., CC-BY 4.0) should be included for each asset.
- For scraped data from a particular source (e.g., website), the copyright and terms of service of that source should be provided.
- If assets are released, the license, copyright information, and terms of use in the package should be provided. For popular datasets, `paperswithcode.com/datasets` has curated licenses for some datasets. Their licensing guide can help determine the license of a dataset.
- For existing datasets that are re-packaged, both the original license and the license of the derived asset (if it has changed) should be provided.
- If this information is not available online, the authors are encouraged to reach out to the asset's creators.

13. **New Assets**

Question: Are new assets introduced in the paper well documented and is the documentation provided alongside the assets?

Answer: [Yes]

Justification: The Vision-Cell framework introduced in this paper is a new asset, and detailed documentation is provided alongside the code and models, including instructions for usage, training, and evaluation. The assets are released via a GitHub repository with a structured template to ensure easy reproducibility (see Section 3.3).

Guidelines:

- The answer NA means that the paper does not release new assets.
- Researchers should communicate the details of the dataset/code/model as part of their submissions via structured templates. This includes details about training, license, limitations, etc.
- The paper should discuss whether and how consent was obtained from people whose asset is used.

- At submission time, remember to anonymize your assets (if applicable). You can either create an anonymized URL or include an anonymized zip file.

14. **Crowdsourcing and Research with Human Subjects**

    Question: For crowdsourcing experiments and research with human subjects, does the paper include the full text of instructions given to participants and screenshots, if applicable, as well as details about compensation (if any)?

    Answer: [No] ,

    Justification: The paper does not involve crowdsourcing or research with human subjects, as it focuses on computational experiments using biological data obtained through non-human means

    Guidelines:

    - The answer NA means that the paper does not involve crowdsourcing nor research with human subjects.
    - Including this information in the supplemental material is fine, but if the main contribution of the paper involves human subjects, then as much detail as possible should be included in the main paper.
    - According to the NeurIPS Code of Ethics, workers involved in data collection, curation, or other labor should be paid at least the minimum wage in the country of the data collector.

15. **Institutional Review Board (IRB) Approvals or Equivalent for Research with Human Subjects**

    Question: Does the paper describe potential risks incurred by study participants, whether such risks were disclosed to the subjects, and whether Institutional Review Board (IRB) approvals (or an equivalent approval/review based on the requirements of your country or institution) were obtained?

    Answer: [No]

    Justification: The paper does not involve research with human subjects, and therefore, IRB approval or equivalent is not applicable.

    Guidelines:

    - The answer NA means that the paper does not involve crowdsourcing nor research with human subjects.
    - Depending on the country in which research is conducted, IRB approval (or equivalent) may be required for any human subjects research. If you obtained IRB approval, you should clearly state this in the paper.
    - We recognize that the procedures for this may vary significantly between institutions and locations, and we expect authors to adhere to the NeurIPS Code of Ethics and the guidelines for their institution.
    - For initial submissions, do not include any information that would break anonymity (if applicable), such as the institution conducting the review.