Khmer Sign Language Recognition System

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Background:

- The total population of 16 million people in Cambodia, there are 1.5 million who are deaf and hearing impaired. Approximately 3.5% of 1.5 million deaf people are profoundly deaf [1].
- Challenges: face communication problems with ordinary people, and it makes deaf people hard to socialize and in the educational sector.

Source: Deaf Development Programme Cambodia

Problems:

- A significant communication gap exists between the hearing-impaired community and non-signers, leading to social isolation and difficulties in accessing education.
- Traditional communication methods are insufficient, and there is a need for technology that can bridge this gap in real-time.
- Sign language is not universal, and there is a need to develop a proper one for Khmer Language.

Khmer: ខ្ញុំ
English: I

Khmer: អ្នក
English: You

Proposed Solution:

- Solution: a real-time recognition system for Khmer Sign Language [2].
- Develop a machine learning and AI algorithm to interpret KSL gestures [3,4].
- The system will translate sign language into text and voice, providing a bridge for communication between the deaf community and non-signers.
- The system will also be used in educational settings to support KSL instruction

Proposed Method:

- To successfully build this system, several stages are identified.
- **Data Collection**: Collaborating with experts from the National Institute for Special Education (NISE) and Krousar Thmey to identify the sign video to build dataset for training.
- **Data cleaning and pre-processing**: clean and label data for training machine learning.
- **Model Training**: The project uses state-of-the-art neural networks, particularly Vision Transformers, for video classification to recognize KSL gestures accurately.
- **Application Development**: A web application will allow users to perform sign language gestures in front of a camera (webcam or smartphone). The system will preprocess the captured frames, extract features, and translate the gestures into text and voice feedback

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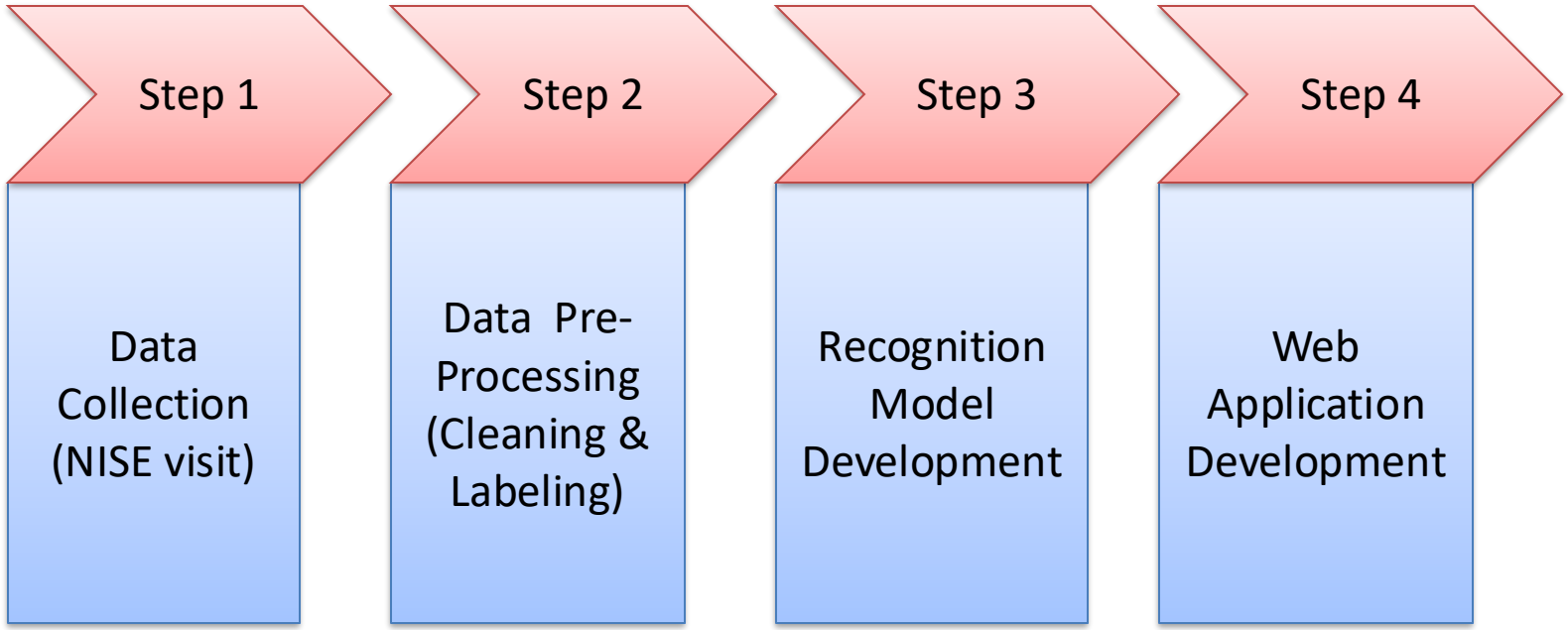
Project Implementation:



Application Process:

Video Frame

Recognition Model

Result in text
(ខែ)

Result in voice form
(ខែ)

Outcomes:

- Khmer Sign Language dataset: can be used as a baseline dataset for further research.
- Web application: deaf people are able to use this app by performing the sign video in front of the webcam and the AI model will then recognize those words.

Impacts:

- Improved Communication for Deaf and Hearing-Impaired Communities.
- **Educational Advancement**: the system's integration into educational environments is a crucial impact, as it will assist both teachers and students in learning KSL, particularly for students in five special education high schools under MoEYS.
- **Increased Social Inclusion and Reduced Isolation**: it helps reduce the isolation that hearing-impaired individuals often experience by making it easier for them to communicate with non-signers.
- **Potential for Regional Impact**: the expansion of the system to support sign languages from other ASEAN countries increases its potential to impact not just Cambodia but the wider Southeast Asian region

Conclusion:

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Reference:

[1] Derrington, A. (2022, January 20). The (Lack of) Deaf Culture in Cambodia — Ashley Derrington. Ashley Derrington. https://www.ashleyderrington.com/blog/post-5#:~:text=Of%20those%2016%20million%2C%20roughly,deaf%20person%20in%20the%20world.

[2] Li, D., Opazo, C. R., Yu, X., & Li, H. (2019). Word-level Deep Sign Language Recognition from Video: A New Large-scale Dataset and Methods Comparison. arXiv (Cornell University). https://doi.org/10.48550/arxiv.1910.11006

[3] Carreira, J., & Zisserman, A. (2017). Quo Vadis, action recognition? a new model and the Kinetics dataset. arXiv (Cornell University). https://doi.org/10.48550/arxiv.1705.07750

[4] Arnab, A., Dehghani, M., Heigold, G., Sun, C., Lučić, M., & Schmid, C. (2021). ViViT: a video vision transformer. arXiv (Cornell University). https://doi.org/10.48550/arxiv.2103.15691

Thank You For Your Kind Attention

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