Enhancing Tagalog-to-English Pronoun Translation with BART

Introduction

Machine translation (MT) systems, such as Google Translate, have long struggled with translating gender-neutral languages like Hungarian, Tagalog, and Estonian. These challenges stem not only from mistranslations of the original meaning but also from improper handling of gender-related contexts (Vanmassenhove, 2024). Pronoun mistranslation, in particular, can lead to significant inaccuracies and even controversies. This project focuses on addressing these issues, with a specific emphasis on pronoun translation.

Tagalog, spoken by approximately 35.2 million people in the Philippines, is a gender-neutral language. Its third-person pronoun siya is used to refer to individuals across the gender spectrum (Dela Cruz, 2023). This pronoun can mean "he," "she," or "they," depending on the context, presenting a unique challenge for MT models when translating into English, a language with more explicitly gendered pronouns.

The lack of enough annotated data makes it even harder for MT models to handle the complexities of translating gender-neutral pronouns (Endriga & Rosario, 2023). This project aims to tackle this issue by fine-tuning the BART model to improve how it translates gender-neutral pronouns from Tagalog to English. The goal is to enable the model to accurately translate ambiguous pronouns like siya as "they" in gender-neutral contexts, matching modern English usage.

Background

In Tagalog, pronoun usage is context-dependent, with siya translating to "he," "she," or "they" depending on the context. However, MT systems often default to gendered pronouns due to a lack of contextual understanding, resulting in biased and inaccurate translations (Endriga & Rosario, 2023). Similar issues have been noted in other gender-neutral languages like Hungarian (Laki & Yang, 2022).

This project tackles these challenges by creating a custom dataset of Tagalog sentences annotated with gender-neutral and gender-specific pronouns. Using BART (Lewis et al., 2020), a pre-trained model well-suited for sequence-to-sequence tasks, and the fairseq toolkit (Ott et al., 2019), the project aims to improve pronoun translation from Tagalog to English with a focus on contextual understanding. By addressing the lack of annotated training data, the goal is to ensure that gender-neutral pronouns like siya are accurately translated as "they" where appropriate.

Methodology

Data Preparation:

The primary dataset consists of 602 Tagalog-English sentence pairs annotated with gender-neutral and gender-specific pronouns. These annotations help guide the model in translating gender-neutral pronouns like siya correctly based on context. The dataset was designed to capture a wide range of sentence structures and contexts, addressing the imbalance in existing Tagalog corpora and enhancing diversity in training examples. It was split into training and

validation sets to ensure balanced representation. Tables 1 and 2 show examples of these sentences and annotations.

Tagalog Sentence	Tagged Sentence
Siya ay nagbabasa.	Siya [singular, third-person, gender-neutral] ay nagbabasa.
Sila ay nagbabasa.	Sila [plural, third-person] ay nagbabasa.
Si Maria ay nagluluto. Siya ay kumakain.	Si Maria ay nagluluto. Siya [singular, third-person, gender-specific] ay kumakain.
Si Juan ay tumatakbo. Siya ay uhaw.	Si Juan ay tumatakbo. Siya [singular, third-person, gender-specific] ay uhaw.
Siya ay nagkakamot.	Siya [singular, third-person, gender-neutral] ay nagkakamot.
Si Maria ay nagluluto. Siya ay kumakain.	Si Maria ay nagluluto. Siya [singular, third-person, gender-specific] ay kumakain.
Sila ay nagtatrabaho sa opisina.	Sila [plural, third-person] ay nagtatrabaho sa opisina.
Ito ay kanyang libro.	Ito [singular, possessive, gender ambiguous] ay kanyang libro.
Ang guro ay nagtuturo. Siya ay masipag.	Ang guro ay nagtuturo. Siya [singular, third-person, inferred gender] ay masipag.

Table 1. Tagalog sentences are shown in column 1 and the tagalog sentences with tagged pronouns are shown in the second column.

English Translation	Pronoun Annotation
They are reading.	Pronoun = "they," singular, gender-neutral
They are reading.	Pronoun = "they," plural
Maria is cooking. She is eating.	Pronoun = "she," singular, gender-specific
Juan is running. He is thirsty.	Pronoun = "he," singular, gender-specific
They are itching.	Pronoun = "they," singular, gender-neutral
Maria is cooking. She is eating.	Pronoun = "she," singular, gender-specific
They are working in the office.	Pronoun = "they," plural
This is his/her book.	Possessive pronoun, gender ambiguous
The teacher is teaching. She is hardworking.	Pronoun = "she," singular, inferred gender

Table 2. The English translations of the Tagalog sentences from table 1 are shown in column one and the English Pronoun Annotation are shown in column 2.

Model and Training:

The BART (Bidirectional and Auto-Regressive Transformers) model developed by Facebook AI, was selected for this project due to its capability to handle sequence-to-sequence tasks, such as machine translation. Additionally, its encoder-decoder architecture makes it well-suited for handling tasks like translating gender-neutral pronouns in context. (Lewis et al., 2020).

The model was fine-tuned using the annotated dataset to enable it to correctly translate ambiguous pronouns. Training was conducted on a GPU using PyTorch and the Hugging Face Transformers library, with early stopping implemented to prevent overfitting.

Evaluation:

The model was evaluated using a combination of metrics and manual analysis to assess its performance in translating gender-neutral pronouns and maintaining contextual accuracy. BLEU Score was used to measure translation quality by comparing n-grams in the generated and reference translations, while Precision, Recall, and F1 Score evaluated the model's ability to predict pronouns accurately. Word-Level Accuracy assessed the correctness of individual word translations, particularly pronouns, providing insights into token-level performance. To complement these automated metrics, a manual error analysis (see Table 7 in the Appendix) was conducted to identify specific patterns in the model's errors, such as pronoun mistranslation, and the introduction of irrelevant content.

Results

The evaluation of the BART model's performance shows mixed results, with some improvements in some areas and some recurring challenges in others. These findings are outlined below:

Overall Evaluation:

```
BLEU Score: 75.98356856515926
Precision: 0.0629
Recall: 0.0630
F1 Score: 0.0620
Accuracy: 0.0630
```

Table 3. Overall Evaluation Metrics

Table 3 shows the overall performance of the model based on the metrics. The model achieved a BLEU score of 75.98, indicating relatively strong alignment between the generated translations and reference sentences. However, the Precision (0.0629), Recall (0.0630), and F1 Score (0.0620) reveal some limitations in the accuracy of translating pronouns while the F1 Score show a low balance between Precision and Recall.
The overall Accuracy of 0.0630 shows that there are some challenges with the model in correctly translating tokens, particularly pronouns, despite its ability to produce grammatically aligned sentences.

Sentence-level testing:

Tables 4, 5, and 6 (see appendix) provides a detailed look at the model's perfomance during sentence-level testing, showing clear patterns in its strengths and weaknesses.

Table 4 shows strong performance with straightforward sentences involving proper nouns. For instance, in "Si Juan ay naglalaro ng basketball" (Juan is playing basketball), the model achieves perfect word-level accuracy. However, it struggles significantly with ambiguous pronouns, often adding irrelevant content. For example, in "Siya ay nagluluto" (They are cooking), the model generates "They are buying fruits," with word-level accuracy ranging from 25% to 40%. The model also faces challenges with plural pronouns. In sentences like "Sila ay nagbabasa ng aklat" (They[pl] are reading a book), it produces unrelated translations such as "They are playing the guitar," with only 16.67% accuracy.

In Table 5, the model's challenges with ambiguous pronouns persisted, and it frequently added irrelevant content. For example, in "Si Maria ay nagsusulat" (Maria is writing), the translation "Maria is washing the dishes. She is careful" introduced unnecessary details and achieved only 25% word-level accuracy. Similarly, in "Siya ay natutulog" (They are sleeping), the translation "They are walking to the office" reflected both a lack of contextual understanding and an irrelevant addition, achieving just 33.33% accuracy.

Table 6 highlights recurring issues with pronouns like *siya* and *sila*. In "Siya ay nagluluto" (They are cooking), the translation "They are buying fruits" again failed to align with the original context, achieving only 25% word-level accuracy. However, the model occasionally showed improvement in handling contextual alignment. For instance, in "Siya ay nag-aaral ng Ingles" (They are studying English), the pronoun translation was accurate, though the generated content ("They are studying math") deviated slightly from the original meaning.

Overall, the results from Tables 4, 5, and 6 show that while the model does well with simple and direct sentences, especially those involving proper nouns, it often adds irrelevant details and the word-level accuracy show that the model struggles to translate the pronouns. These issues highlight the need for more training on diverse and contextually ambiguous sentences.

Manual Error Analysis:

A manual error analysis of Table 4 shown in Table 7 (see appendix) provides further insight into the model's performance, focusing on pronoun translation and contextual alignment. The analysis reveals that the model consistently translates pronouns correctly, rendering siya and sila as they(sg) and they(pl) respectively. However, it frequently fails to align actions and verbs with the original context. For example, in "Siya ay nagluluto" (They are cooking), the model produces "They are buying fruits," demonstrating a clear mismatch in verb alignment. Additionally, irrelevant content appears in 4 out of 7 sentences, such as "She is good" in "Si Maria ay nagsusulat" (Maria is writing). These findings highlight the model's strengths in pronoun translation but also underscore its struggles with maintaining semantic and contextual accuracy.

Discussion

This project directly addresses the challenges of translating gender-neutral pronouns, such as siya and sila, from Tagalog to English. As outlined in the introduction and background, existing MT systems often default to gendered pronouns or fail to account for context, resulting in inaccuracies and biases (Vanmassenhove, 2024; Endriga & Rosario, 2023). This project successfully demonstrates that the BART model can translate siya as they(sg) and sila as they(pl), which is a significant step toward handling gender-neutral pronouns in MT systems. However, the model still struggles with contextual alignment and frequently introduces irrelevant content. Such as, in "Siya ay nagluluto" (They are cooking), the model misaligns the verb, generating "They are buying fruits." Similarly, in "Si Maria ay nagsusulat" (Maria is writing), the model adds unnecessary details, such as "She is good," which detracts from the accuracy of the translation.

The model performs well with straightforward sentences involving proper nouns, such as "Si Juan ay naglalaro ng basketball" (Juan is playing basketball), achieving perfect word-level accuracy without irrelevant additions. However, its performance declines significantly with ambiguous or plural pronouns. For instance, in "Sila ay nagbabasa ng aklat" (They[pl] are reading a book), the translation "They are playing the guitar" scores just 16.67% word-level accuracy. For a native speaker, the translation of siya and sila to they aligns with the meaning, even if the word-level accuracy metrics do not fully reflect this understanding. This highlights a gap between human interpretation and model evaluation metrics, suggesting a need for more nuanced ways to measure success (Dela Cruz, 2023).

Several factors likely contributed to these results. A key limitation is the dataset itself, which was created for this project and may inherently carry biases. As the dataset was designed manually, it is possible that certain patterns or contexts were overrepresented or underrepresented, limiting the model's ability to generalize effectively to more complex cases. Additionally, the dataset's size and diversity constrain the model's capacity to learn subtle linguistic nuances, particularly those required for interpreting ambiguous pronouns. Expanding the dataset to include a wider variety of pronoun usage and sentence structures

would address these limitations and likely improve the model's performance (Ilao et al., 2016).

While the project successfully achieves its primary goal of enabling the model to translate siya and sila to they, further tweaking and fine-tuning are needed to address issues like contextual misalignment and irrelevant content generation. The BART model, despite its strengths, requires a deeper understanding of linguistic context to handle more complex translations effectively (Lewis et al., 2020; Ott et al., 2019).

Future work should explore the use of alternative models like facebook/mbart-large-cc25, a multilingual model capable of handling diverse languages. Expanding the dataset to include more diverse and contextually ambiguous examples is essential for improving the model's ability to generalize. Additionally, incorporating complementary evaluation metrics beyond BLEU, such as semantic and context-specific accuracy, will provide more reliable insights into model performance. These steps will enhance the accuracy and inclusivity of Tagalog-to-English translation systems (Vanmassenhove, 2024; Laki & Yang, 2022).

This project is an important step toward addressing the challenges of translating gender-neutral pronouns in MT systems. By enhancing the translation of ambiguous pronouns, it contributes to addressing broader issues of inclusivity and reducing gender bias in AI.

References:

Dela Cruz, Y. F. B. (2023). Siya nga ba'y gender neutral?: A preliminary linguistic analysis of the genderedness of Filipino. UP Working Papers in Linguistics, 2(1), 93-119

Endriga, D. A., & Rosario Jr., F. (2023). Gender bias in machine translation. In *Translation studies in the Philippines*.

Ilao, J., Roxas, R., Sison-Buban, R., Cheng, C., See, S., & Regalado, R. V. (2016). Philippine component of the ASEAN machine translation project.

Laki, L. J., & Yang, Z. G. (2022). Neural machine translation for Hungarian. *Acta Linguistica Academica*, *69*(4), 501–520. https://doi.org/10.1556/2062.2022.00576

Lewis, M., Liu, Y., Goyal, N., Ghazvininejad, M., Mohamed, A., Levy, O., Stoyanov, V., & Zettlemoyer, L. (2020). BART: Denoising sequence-to-sequence pre-training for natural language generation, translation, and comprehension. In *Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics (ACL)* (pp. 7871–7880).

Ott, M., Edunov, S., Grangier, D., & Auli, M. (2019). fairseq: A fast, extensible toolkit for sequence modeling. In *Proceedings of NAACL-HLT 2019: Demonstrations* (pp. 48–53).

Vanmassenhove, E. (2024). Gender bias in machine translation and the era of large language models. *ArXiv*, abs/2401.10016.

Appendix:

```
Original: Siya ay nagluluto.
Expected Translation: They(sg) are cooking.
Generated Translation: They are buying fruits.
Word-Level Accuracy: 25.00%
==================================================
Original: Sila ay nagtatrabaho.
Expected Translation: They(pl) are working.
Generated Translation: They are buying fruits.
Word-Level Accuracy: 25.00%
==================================================
Original: Si Maria ay nagsusulat.
Expected Translation: Maria is writing.
Generated Translation: Maria is cooking a dish. She is good.
Word-Level Accuracy: 25.00%
==================================================
Original: Si Juan ay naglalaro ng basketball.
Expected Translation: Juan is playing basketball.
Generated Translation: Juan is playing basketball.
Word-Level Accuracy: 100.00%
==================================================
Original: Siya ay natutulog.
Expected Translation: They(sg) are sleeping.
Generated Translation: They are buying fruits.
Word-Level Accuracy: 25.00%
==================================================
Original: Siya ay nag-aaral ng Ingles.
Expected Translation: They(sg) are studying English.
Generated Translation: They are studying math.
Word-Level Accuracy: 50.00%
==================================================
Original: Sila ay nagbabasa ng aklat.
Expected Translation: They(pl) are reading a book.
Generated Translation: They are playing hide and seek.
Word-Level Accuracy: 16.67%
==================================================
```

Table 4. Sentence-Level Testing (Model Performance)

```
==================================================
Original: Siya ay nag-aaral ng Ingles.
Expected Translation: They are studying English.
Generated Translation: They are washing clothes.
Word-Level Accuracy: 50.00%
Sentence BLEU Score: 23.64
==================================================
Original: Sila ay nagbabasa ng aklat.
Expected Translation: They are reading a book.
Generated Translation: They are writing a story.
Word-Level Accuracy: 60.00%
Sentence BLEU Score: 19.30
==================================================
Original: Siya ay kumakain ng almusal.
Expected Translation: They are eating breakfast.
Generated Translation: They are washing clothes.
Word-Level Accuracy: 50.00%
Sentence BLEU Score: 23.64
==================================================
Original: Si Pedro ay naglilinis ng kotse.
Expected Translation: Pedro is cleaning the car.
Generated Translation: Pedro is painting a picture. He is creative
Word-Level Accuracy: 25.00%
Sentence BLEU Score: 9.29
==================================================
Original: Si Ana ay nagpapatugtog ng piano.
Expected Translation: Ana is playing the piano.
Generated Translation: Ana is playing the piano. She is happy.
Word-Level Accuracy: 62.50%
Sentence BLEU Score: 51.70
==================================================
```

Table 5. Sentence-Level Testing (Model Performance)

```
Original: Siya ay nagluluto.
Expected Translation: They are cooking.
Generated Translation: They are washing the dishes.
Word-Level Accuracy: 40.00%
==================================================
Original: Sila ay nagtatrabaho.
Expected Translation: They are working.
Generated Translation: They are walking to the office.
Word-Level Accuracy: 33.33%
==================================================
Original: Si Maria ay nagsusulat.
Expected Translation: Maria is writing.
Generated Translation: Maria is washing the dishes. She is careful.
Word-Level Accuracy: 25.00%
==================================================
Original: Si Juan ay naglalaro ng basketball.
Expected Translation: Juan is playing basketball.
Generated Translation: Juan is playing basketball. He is good.
Word-Level Accuracy: 57.14%
==================================================
Original: Siya ay natutulog.
Expected Translation: They are sleeping.
Generated Translation: They are walking to the office.
Word-Level Accuracy: 33.33%
==================================================
Original: Siya ay nag-aaral ng Ingles.
Expected Translation: They are studying English.
Generated Translation: They are selling fruits at the market.
Word-Level Accuracy: 28.57%
==================================================
Original: Sila ay nagbabasa ng aklat.
Expected Translation: They are reading a book.
Generated Translation: They are playing the guitar.
Word-Level Accuracy: 40.00%
==================================================
```

Table 6. Sentence-Level Testing (Model Performance)

Original Sentence	**Expected Translation**	**Generated Translation**	**Pronoun Translation Accuracy**	**Irrelevant Content**	**Analysis/Notes:**
Siya ay nagluluto.	They(sg) are cooking.	They are buying fruits.	Correct	No	Correct pronoun (*they)* but verb is contextually wrong.
Sila ay nagtratrabaho.	They(pl) are working.	They are buying fruits.	Correct	No	Correct pronoun but added irrelevant and repeated content .
Si Maria ay nagsusulat.	Maria is writing.	Maria is cooking a dish. She is good.	Not Applicable	Yes	Added irrelevant content ("She is good").
Si Juan ay naglalaro ng basketball.	Juan is playing basketball.	Juan is playing basketball.	Correct	No	Fully accurate translation.
Siya ay natutulog.	They(sg) are sleeping.	They are buying fruits.	Correct	No	Pronoun correct (*they*), but verb is wrong and repeated content.

Siya ay nag-aaral ng Ingles.	They(sg) are studying English.	They are studying math.	Correct	Yes	Correct pronoun but added irrelevant content (*math*).
Sila ay nagbabasa ng aklat.	They(pl) are reading a book.	They are playing hide and seek.	Correct	Yes	Correct pronoun but irrelevant content (*hide and seek)*

Table 7. Manual-Error Analysis of Table 4.