An Overview of BPPT’s Indonesian Language Resources

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Abstract

This paper describes various Indonesian language resources that Agency for the Assessment and Application of Technology (BPPT) has developed and collected since mid 80’s when we joined MMTS (Multilingual Machine Translation System), an international project coordinated by CICC-Japan to develop a machine translation system for five Asian languages (Bahasa Indonesia, Malay, Thai, Japanese, and Chinese). Since then, we have been actively doing many types of research in the field of statistical machine translation, speech recognition, and speech synthesis which requires many text and speech corpus. Most recent cooperation within ASEAN-IVO is the development of Indonesian ALT (Asian Language Treebank) has added new NLP tools.

1 Introduction

As a national language of Indonesia, Bahasa Indonesia has been used as a lingua franca in the multilingual Indonesian archipelago for centuries. Indonesia is the fourth most populous nation in the world, after China, India and the United States. Of its large population, around 255 million people, the majority speak Indonesian, making it one of the most widely spoken languages in the world.

 Aside from speaking the national language, most Indonesians are fluent in any of more than 746 distinct regional languages (Amalia, 2016) such as Javanese, Sundanese and Madurese, which are commonly used at home and within the local community. Most formal education, and nearly all national media and other forms of communication, are conducted in Indonesian. Throughout the archipelago, Bahasa Indonesia has become the language that bridges the language barrier among Indonesians who have different mother-tongues.

 In recent years, countries in the same region tend to establish some free trade areas such as ASEAN Economic Community (AEC), European Union (EU), and Asia-Pacific Economic Cooperation (APEC). This opens opportunities to accelerate economic growth for Indonesia. However, these efforts are hindered due to the lack ability of Indonesians in communicating with foreigners.

 BPPT has started collecting language resources since 1987 as part of the development of a multilingual machine translation system in a project called "The Research and Development Cooperation Project on a Machine Translation System for Japan and its Neighbouring Countries". At the end of the project, many Indonesian language resources have been resulted, such as Indonesian basic dictionary, Indonesian grammar rule for analysis and generation system, Indonesian monolingual text corpus, and Indonesian gazetteer.

 We have continued collecting language resources to improve the system which has been developed and the development of other natural language processing systems. The needs for the development of statistical machine translation with Indonesian as source language, Indonesian speech recognition and Indonesian speech synthesizer led to the development of other language resources, which are parallel corpora and speech corpora for ASR and TTS.

2 Indonesian Gazetteer

Indonesia is the world's largest island country, with more than thirteen thousand islands and has 34 provinces, of which five have Special Administrative status. Indonesia consists of hundreds of distinct...
native ethnic and linguistic groups. This big country also has many districts, regencies, lakes, mounts, ports, airports, rivers, capes, bays, etc. Regarding this diversity, it needed to compile Indonesian Gazetteer as one of the language resources. Table 1 lists entries of the Indonesian Gazetteer.

| No | Name Entity | Number of Data |
|----|-------------|----------------|
| 1  | Province    | 34             |
| 2  | Regency     | 484            |
| 3  | District    | 6,793          |
| 4  | Lake        | 101            |
| 5  | Mount       | 546            |
| 6  | Airport     | 137            |
| 7  | Harbour     | 295            |
| 8  | Island      | 948            |
| 9  | River       | 586            |
| 10 | Cape        | 627            |
| 11 | Bay         | 301            |
| 12 | Tribe       | 358            |
| 13 | Weapon      | 272            |
| 14 | Art         | 245            |

Table 1: Lists entries of the Indonesian gazetteer

3 Indonesian Monolingual Corpus

Up to now, we have collected around 10.5 million sentences in an Indonesian monolingual corpus. The sentences were taken from various sources available on the internet such as national newspapers/magazines and governmental institutions (presidential speech, meeting transcriptions, trial transcriptions, etc.) by using HTTrack, a free offline browser utility (Roche et al., 2007). Table 2 lists all the corpora obtained from various sources.

| Topic      | Source                                | Number of articles | Number of sentences | Number of unique sentences | Number of words | Number of unique words |
|------------|---------------------------------------|--------------------|---------------------|---------------------------|----------------|-----------------------|
| Financial  | Bank of Indonesia                     | 124                | 115,431             | 113,615                   | 3,081,380      | 28,421                |
| Various topics | DPR (House of Representative)     | 355                | 205,405             | 202,816                   | 4,293,868      | 48,525                |
| Law        | PN (District Court)                  | 12                 | 39,075              | 38,733                    | 662,964        | 17,803                |
| Various topics | Presidential speech                 | 16                 | 1,268               | 1,266                     | 24,695         | 3,502                 |
| Financial  | Ministry of Finance                  | 46                 | 6,172               | 6,153                     | 135,981        | 8,945                 |
| Various topics | Mail archive                     | 3,685              | 68,455              | 56,267                    | 1,092,195      | 45,323                |
| Financial  | BPK (Supreme Audit Board)            | 501                | 862,542             | 831,334                   | 35,521,560     | 127,108               |
| Various topics | DPD (House of Regional Representative) | 755              | 450,270             | 444,836                   | 9,902,733      | 72,147                |
| Politics   | KPU (National Election Commission)   | 1,176              | 23,503              | 16,734                    | 399,182        | 19,042                |
| Topic       | Source                          | Number of articles | Number of sentences | Number of unique sentences | Number of words     | Number of unique words |
|-------------|--------------------------------|--------------------|---------------------|---------------------------|---------------------|------------------------|
| Law         | Ministry of Justice and Human Rights | 6,222              | 361,140             | 349,630                   | 8,796,144           | 51,326                 |
| Literature  | Novels                          | 110,943            | 5,760,141           | 5,684,129                 | 72,605,688          | 396,736                |
| Various     | National newspaper/magazine      | 28,795             | 609,728             | 609,275                   | 12,484,728          | 111,574                |
| Law         | MK (Constitutional Court)        | 7,293              | 1,992,251           | 1,912,706                 | 36,741,176          | 163,397                |
| Various     | Combination of all above        | 159,923            | 10,495,381          | 10,445,098                | 185,602,460         | 647,982                |

Table 2: Indonesian monolingual text corpus

4 Indonesian-English Parallel Corpus

| No | Source            | Topic               | Number of sentences | Number of unique sentences |
|----|-------------------|---------------------|---------------------|----------------------------|
| 1  | ASEAN MT¹         | Tourism             | 21,969              | 19,359                     |
| 2  | BBC               | News                | 5,284               | 5,083                      |
| 3  | BTEC              | Tourism             | 133,453             | 127,815                    |
| 4  | Indonesian Ministry of Finance ² | Economics | 48,778             | 46,400                     |
| 5  | PanL              | Economics           | 6,708               | 6,677                      |
| 6  | PanL              | Science and Technology | 10,431           | 10,404                     |
| 7  | PanL              | National news       | 10,141              | 10,141                     |
| 8  | PanL              | Sports              | 14,217              | 14,216                     |
| 9  | PanL              | International news  | 9,993               | 9,993                      |
| 10 | Tatoeba³          | Various topics      | 4,179               | 3,694                      |
| 11 | U-STAR³           | Tourism             | 6,500               | 6,451                      |
| 12 | Warisan Indonesia | Tourism             | 7,517               | 7,161                      |
| 13 | Colours Magazine Garuda⁶ | Tourism | 10,603             | 10,400                     |
| 14 | Various expatriate blogs | Culture | 33,943             | 33,943                     |
| 15 | Asian Language Treebank (ALT)⁷ | WikiNews | 20,000             | 20,000                     |

Table 3: Indonesian-English parallel corpus

¹ (AseanMT, 2014)
² (Kemenkeu, 2015)
³ (PanL, 2010)
⁴ (Tatoeba, 2012)
⁵ (Ustar, 2013)
⁶ (Garuda-Indonesia, 2013)
⁷ (Asian Language Treebank, ASEAN-IVO)
PTIK-BPPT collected around 311,737 sentences in an Indonesian-English parallel corpus to aid our research in statistical machine translation. The sentences were taken from various sources available on the internet such as national newspapers/magazines and governmental institutions by using HTTrack, a free offline browser utility. We hired some professional translators to check the correctness of the parallel corpus manually. Table 3 lists all parallel corpus obtained from various sources.

The Asian Language Treebank (ALT) project aims to advance the state-of-the-art Asian natural language processing (NLP) techniques through the open collaboration for developing and using ALT. The project is a joint effort of six institutes for making a parallel treebank for seven languages: English, Indonesian, Japanese, Khmer, Malay, Myanmar, and Vietnamese. In creating Indonesian - ALT, it requires tools to speed up the development. Some of these tools have been provided by the ALT project but for Indonesian we will use tools that were created from previous projects. Among them are POS Tagger, Syntax Tree Generator, Shallow Parser, word alignment, etc. Indonesian treebank resulted from this project will be utilize to enhance the existing tools and to create new tools in the field of NLP using state of the art techniques. Indonesian treebank is also expected to help the advancement of NLP researches in Indonesia.

5 Automatic Speech Recognition

To develop automatic speech recognition (ASR) system, training data in the form of speech corpus is required. The speech corpus for ASR must have a rich combination of uttered phonemes in the targeted language. And to make the ASR system speaker independent, the corpus should be created from speech recordings of many speakers with various ages and gender. Currently we have two set of speech corpus created for Indonesian ASR. The first one was made in 2010 for the joint development project with PT. INTI[7] to develop an Indonesian ASR system called PERISALAH. This speech corpus, consists of total 100,000 utterances uttered by 400 people. The utterances were coming from around 7800 unique sentences. The speakers consists of 200 adults male and 200 adults female, with the following composition: 40% Javanese, 20% Sundanese, 20% from Batak, 5% from Minang, 5% from Makassar, 5% from Maluku, and 5% from Papua, Bali and Madura. The ages of the speakers are within 20 to 50 years old. The total duration of the speech data is more than 133 hours. The average time per utterance is around 5 seconds, the longest utterance time is 22 seconds, and the shortest utterance time is 1.5 seconds. The speech data in this corpus was recorded as a single channel data with a 16KHz sampling rate and a 16-bit data size. The file format used for storing the data is WAV format. This first corpus set was already tested to create an acoustic model for Indonesian ASR with WER of around 20% using Julius[8] as the ASR engine. Since the PERISALAH corpus was created as a joint development, the ownership was a shared one, so it is not publicly available.

The second set of the corpus was created in 2013, this second corpus was planned to be made publicly available for research and education purposes. The second corpus consists of total 49,000 utterances uttered by 200 people, where each person speaks around 245 sentences. The speakers were consists of 100 male and 100 female, and the age-range were within 15 to 50 years old. Around 30% of the speakers were high-school students. The sentence used in this corpus comes from 5,000 unique sentences. The file format used to store the data is WAV with single channel recording, a 16KHz sampling rate and a 16-bit data size. The total duration of the speech data is more than 95 hours. The average time per utterance is around 6.8 seconds, the longest utterance time is 29 seconds, and the shortest utterance time is 1.0 seconds. This second corpus is planned to be released for research and education community at the end of 2016.

6 Speech Corpus for The Development of An Indonesian TTS System

For developing an Indonesian TTS system, PTIK-BPPT now uses 3 sets of speech corpus. Set 1 and 2 consists of 5,000 WAV files each, and set 3 consists of 15,645 WAV files. Table 4 describes details of the speech corpus.
| Set no. | Speaker       | Number of Utterances | Length (hours) | Format              |
|---------|---------------|----------------------|----------------|---------------------|
| 1       | male adult    | 5,000                | 6.56           | wav, 16-bit, 16KHz  |
| 2       | female adult  | 5,000                | 7.13           | wav, 16-bit, 16KHz  |
| 3       | male adult    | 15,645               | 40.25          | wav, 16-bit, 16KHz  |
| 3       | female adult  | 15,645               | 30.52          | wav, 16-bit, 16KHz  |

Table 4: Speech TTS corpus.

The following table lists types of sentences in each speech corpus set:

| Set no. | Sentence type | Number of regular sentences | Number of declarative sentences | Number of interrogative sentences | Number of imperative sentences | Number of exclamatory sentences |
|---------|---------------|------------------------------|---------------------------------|-----------------------------------|--------------------------------|--------------------------------|
| 1       |               | 3,715                        | 4,532                           | 353                               | 9                              | 106                            |
| 2       |               | 3,809                        | 4,566                           | 321                               | 9                              | 104                            |
| 3       |               | 14,173                       | 14,554                          | 415                               | 45                             | 631                            |

Table 5: Sentence types

7 Conclusion

BPPT has collected language resources to develop Indonesian-English statistical machine translation system, Indonesian ASR and text-to-speech system. The language resources will help the advancement of MT, ASR, and TTS research in Bahasa Indonesia and any NLP-related research in general. The existing data is enough for developing MT, ASR and TTS for the Bahasa Indonesia language but it needs more efforts. We have developed MT, ASR and TTS systems based on this data with adequate performance. Currently we also involved in the development of Asian Language Treebank to enrich our NLP resources. Currently all resources are for internal use only, but in the end of 2016 we are planning to release most of these resources for research and education communities under Common Criteria (CC-BY).

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