PREVENTING DUPLICATION OF DIGITAL AUDIO FILE IN PERSONAL DEVICE USING BIOLOGICALLY-INSPIRED AUDIO STORING MANAGEMENT PROCESS (BIASMP)

Hammuzamer Irwan Hamzah[1], Low Tan Jung[2], and Ariffin Abdul Mutalib[3]

[1] Universiti Utara Malaysia, Malaysia, zamer@uum.edu.my
[2]Universiti Teknologi Petronas, Malaysia, lowtanjung@petronas.com.my
[3] Universiti Utara Malaysia, Malaysia, am.ariffin@uum.edu.my

ABSTRACT. This paper presents biologically-inspired audio storing management process (BiASMP) to prevent duplication of digital audio file in personal storage. There are certain digital music application tools that detect duplication and provide cleaning function. However duplication still happen until the software is executed by user. This paper inspires the biologically human concept to create a process that capable to prevent duplication of digital audio files from the start of the file is inserted into the personal device. The elements to establish BiASMP are analyzed and studied. Comparative analysis between current tools and BiASMP is made and the results of exemplar simulations are shown to authenticate the developed process.

Keywords: biologically-inspired, digital audio file, software engineering, audio database

INTRODUCTION

Digital music application tools like Abee mp3 duplicates finder, dupeGuru Music Edition, Duplicate Cleaner - Find Duplicate Files, Duplicate Music Files Finder, MusicBee - Music Manager and Player, Similarity, and TuneUp can detect duplication of digital audio files in a personal device, but cannot prevent them from occurring. BiASMP can prevent it from the start of the file being inserted into personal device by recognition function and provides cognitive and constructive learning function (CCL Algorithm) to assist user for adding files which only not in their hard disk yet (Hamzah & Tan Jung, 2012). This paper describes how BiASMP is developed and how it works.

ELEMENTS OF BIASMP

BiASMP adapts the human ear (Reynolds, 2004) as the interface to accept and configure the inserted file and send it the matching process. Here, the human brain (Dubin, 2001) is adapted as the processor for the matching process and as the memory (Squire, 2004) for the storage of the file. Beside the brain and memory process, for the matching procedure, this study introduces the cognitive (Pribram, 1986) and constructive (Parekh, Yang, & Honavar, 2000) learning functions for giving support to the user to store only the desired file. Besides the biologically-inspired elements, there are several elements of digital audio concept adapted for the development of BiASMP based on the requirements and issues suggested by Adjeroh & Nwosu, (1997) and Grosky, (1997). The explanation of the elements for BiASMP is described more in detail by (Hamzah & Tan Jung, 2012).

HOW BIASMP WORKS?

Other digital music application tools detect duplicate file in personal device from the hard disk itself and move the duplicated files into another location, this can be seen in Figure 1. Another software to detect duplication of digital music records is like iTunes (2013), the process is such as shown in Figure 2. Here, the duplication occurs, no prevention service to block similar file is provided. Moreover, user themselves still need to delete the duplicated file in the duplicate folder to optimize the storage.

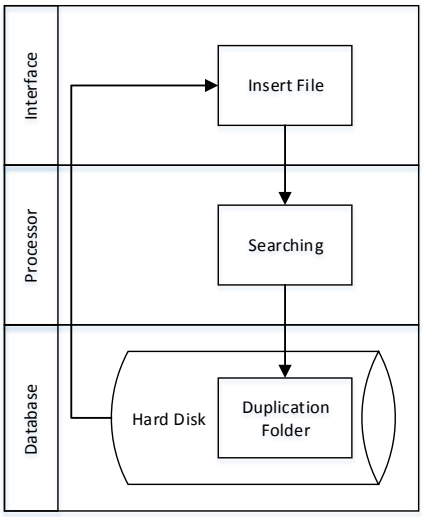

Figure 1. Digital Music Application Duplicate Detection Model

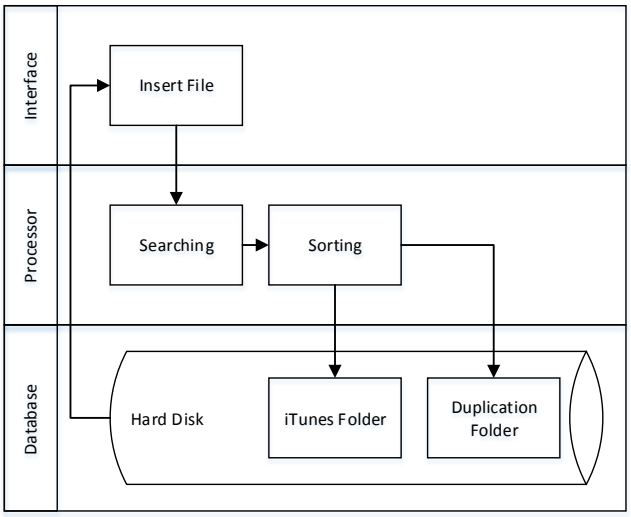

Figure 2. iTunes Duplicate Detection Model

As for these reasons, there should be a well-managed process to recognize and learn any inserted music record. Furthermore, there should also be a mechanism that provide assistant to organize the storage of a personal device. Therefore, a management process to prevent duplication from happening since the file being inserted into personal device is required. As for that, BiASMP can keep the storage optimized with the implementation of CCL approach (Hamzah & Tan Jung, 2012) such as the concept is shown in Figure 3.

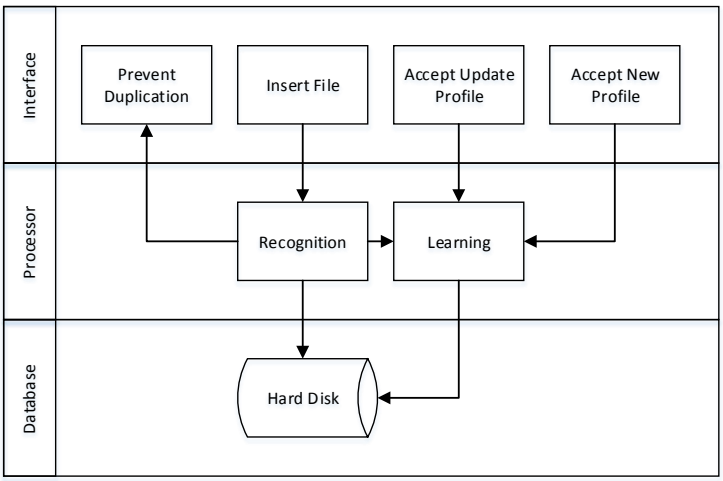

Figure 3. BiASMP Prevention Model

SIMULATIONS AND RESULTS

Comparative Analysis

A comparative analysis is made to express the features of BiASMP. A list of features to prevent duplication of digital audio files in personal device has been analyzed and identified. The digital music software like; (1) MusicBee, (2) TuneUp, (3) Duplicate Music file Finder, (4) Duplicate Cleaner, (5) Similarity, (6) Abee mp3 duplicates finder, and (7) dupeGuru Music Edition are compared with (8) BiASMP. The given numbers represent the tools in the header column of Table 1. The left side column is the analyzed features, and the other columns are the tools and their capabilities. Table 1 shows the results of the empirical analysis that has been done.

Table 1. Comparative Analysis

Features	1	2	3	4	5	6	7	8
Detect duplicate file	/	/	/	/	/	/	/	/
Clean duplicate file	-	-	-	-	-	-	-	/
Recognize file before inserted	-	-	-	-	-	-	-	/
Search storage for similar file before inserting file	-	-	-	-	-	-	-	/
Filter file before stored into personal device	-	-	-	-	-	-	-	/
Implement multimedia data modeling	-	-	-	-	-	-	-	/
Implement MPEG-7 DSs	-	-	-	-	-	-	-	/
Implement DRM	-	-	-	-	-	-	-	/
Implement audio watermarking	-	-	-	-	-	-	-	/
Implement audio fingerprinting	/	/	/	/	/	/	/	/
Implement content based retrieval	/	/	/	/	/	/	/	/
Implement semantic based retrieval	/	/	/	/	/	/	/	/
Implement audio classification	-	-	-	-	/	-	-	/
Implement audio object recognition	/	/	/	/	/	/	/	/

Exemplar Settings and Simulations

Exemplar settings show the execution of recognition, cognitive learning, and constructive learning functions and the results obtained. For constructive learning (null record), the simulation starts with an empty storage. The setting for the memoryTable is planned as described in the Table 2.

Table 2. Initial Record in memoryTable

Rec.	Song	Artist	Album
-	-	-	-

The memoryTable is currently empty. For Example 1, the simulation requests the user to add new file. The procedures for this simulation are executed as in the Example 1. After adding the new file into the memoryTable, the first record is as shown in Table 3.

```
Example 1: Adding File
SET environment
inputFile = Selamat Tinggal Akhirnya.mp3
memoryTable = null
EXECUTE ccl
ACCEPT newProfile
DO constructiveLearning
UPDATE memoryTable = {Selamat Tinggal Akhirnya.mp3}
```

Table 3. New learning in memoryTable

Rec.	Song	Artist	Album
1.	Selamat Tinggal Akhirnya.mp3	Aizat	Percubaan Pertama

Example 1 exhibits the constructive learning function. Example 2 shows recognition function (similar object). The simulation of Example 2 for recognition function only may be performed after the memoryTable is not null. From the Example 1 in the previous section, the record in the memoryTable enables the recognition function to be performed. To match the record, the setting for the procedures in Example 2 is planned as below.

```
Example 2: Matching Same Record
SET environment
inputFile = Selamat Tinggal Akhirnya.mp3
memoryTable = {Selamat Tinggal Akhirnya.mp3}
EXECUTE ccl
ACCEPT listedRecord
DO recognition
DO duplicatatePreventionAction
```

From Example 2, a perfect match occurs due to the same files are matched. BiASMP executes recognition function. BiASMP executes prevention action. User is assisted not to store the same file into personal device. For similarity in object features, Example 3 shows the cognitive learning function of adding new file with same object features. This setting is with the same artist and the same album, but the song is different. The procedures are planned as below. After adding the new the file into the memoryTable, the records increase like shown in Table 4.

```
Example 3: Adding New File – Cognitive Learning (i)
SET environment
inputFile = Cintai Diriku.mp3
memoryTable = {Selamat Tinggal Akhirnya.mp3}
EXECUTE ccl
ACCEPT updateProfile
DO cognitiveLearning
UPDATE memoryTable = {Cintai Diriku.mp3}
```

Table 4. Cognitive Learning in memoryTable

Rec.	Song	Artist	Album
1.	Selamat Tinggal Akhirnya.mp3	Aizat	Percubaan Pertama
2.	Cintai Diriku.mp3	Aizat	Percubaan Pertama

Example 4 shows another simulation for adding new file with different object feature of same artist is used but with different album setting. The settings are planned as below. After adding the new file using different setting of the same artist but with the different album, it increases the record in the memoryTable. Table 5 shows the records in the memoryTable.

Example 4: Adding New File – Cognitive Learning (ii)

```
SET environment,
inputFile = I Go.mp3
memoryTable = {Selamat Tinggal Akhirnya.mp3, Cintai
Diriku.mp3}
EXECUTE ccl
ACCEPT updateProfile
DO cognitiveLearning
UPDATE memoryTable = {I Go.mp3}
```

Table 5. Update Learning in historyMemory with Different Object

Rec.	Song	Artist	Album
1.	Selamat Tinggal Akhirnya.mp3	Aizat	Percubaan Pertama
2.	Cintai Diriku.mp3	Aizat	Percubaan Pertama
3.	I Go.mp3	Aizat	OST Talent Time

There is another simulation to show that BiASMP capable to organize audio storage with totally different object. Example 5 exhibits the constructive learning function of a totally different object. The procedures for the example are planned as below. Table 6 shows the newly added record is listed in the memoryTable. With all the examples exhibited above, it describes the recognition function, the cognitive learning function, and the constructive learning function.

Example 5: Adding New File

```
SET environment,
inputFile = Faizal Tahir – Hanyut (Akustik).mp3
memoryTable = {Selamat Tinggal Akhirnya.mp3, Cintai
Diriku.mp3, I Go.mp3}
EXECUTE ccl
ACCEPT newProfile
DO constructiveLearning
UPDATE memoryTable = {Faizal Tahir – Hanyut (Akustik).mp3}
```

Table 6. Constructive Learning in memoryTable with Different Object

Rec.	Song	Artist	Album
1.	Selamat Tinggal Akhirnya.mp3	Aizat	Percubaan Pertama
2.	Cintai Diriku.mp3	Aizat	Percubaan Pertama
3.	I Go.mp3	Aizat	OST Talent Time
4.	Faizal Tahir – Hanyut (Akustik).mp3	Faizal Tahir	Adrenalin

CONCLUSION

As for the conclusion, BiASMP adapts biologically-inspired concept from the human ear, human brain, and the distinctions of human learning perspectives. It is better from the other application tools because it prevents from duplication of digital audio file to occur in the hard disk of a personal device. Furthermore, comparative analysis shows the advantages of BiASMP corresponding to other music management software. With the simulations of exemplar settings, the results proved that BiASMP can prevent duplication of digital audio file in a personal device.

REFERENCES

Abee mp3 duplicates finder. (2008).*AbeeTech*. Retrieved April 7, 2013, from http://abeetech.com/mp3-duplicates-finder/

Adjeroh, D. a, & Nwosu, K. C. (1997). Multimedia database management-requirements and issues. *IEEE International Conference on Multimedia*, *4*(3), 24–33. Retrieved from http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=621580

Archived - iTunes 8: Finding and removing duplicate items. (2013).*apple.com*. Retrieved January 20, 2013, from http://support.apple.com/kb/ht1417

Dubin, M. W. (2001). *How the Brain Works* (p. 125).

dupeGuru Music Edition. (2012).*Hardcoded Software*. Retrieved April 7, 2013, from http://www.hardcoded.net/dupeguru_me/

Duplicate Cleaner - Find Duplicate Files. (2012).*Digital Volcano*. Retrieved April 7, 2013, from http://www.digitalvolcano.co.uk/content/duplicate-cleaner

Duplicate Music Files Finder. (2008).*LC IBros Solutions*. Retrieved April 7, 2013, from http://www.lcibrossolutions.com/dmff

Grosky, W. I. (1997, December 1). Managing multimedia information in database systems. *Communications of the ACM*, *40*(12), 72–80. doi:10.1145/265563.265574

Hamzah, H. I., & Tan Jung, L. (2012). Implementing BiSM and CCL Algorithm for Managing Audio Storage. *Knowledge Management International Conference*.

MusicBee - Music Manager and Player. (2012). Retrieved from http://getmusicbee.com/

Parekh, R., Yang, J., & Honavar, V. (2000). Constructive neural-network learning algorithms for pattern classification. *IEEE transactions on neural networks / a publication of the IEEE Neural Networks Council*, *11*(2), 436–51. doi:10.1109/72.839013

Pribram, K. H. (1986). The cognitive revolution and mind/brain issues. *The American psychologist*, *41*(5), 507–20. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/3729144

Reynolds, T. (2004). Ear, nose and throat problems in Accident and Emergency. *Nursing Standard*, *18*(26), 47–53.

Similarity. (2013).*GAR software*. Retrieved April 7, 2013, from http://www.similarityapp.com/

Squire, L. R. (2004). Memory systems of the brain: a brief history and current perspective. *Neurobiology of learning and memory*, *82*(3), 171–7. doi:10.1016/j.nlm.2004.06.005

TuneUp. (2012).*TuneUp Media*. Retrieved April 7, 2013, from http://www.tuneupmedia.com/