**Format of Paper Outline**

*Recently modified by: (e.g. Berny) on: yyyy.mm.dd.*

**Title**

Tentative title 1

(if needed, tentative titles 2)

**Table of Contents**

|  |
| --- |
| *Guideline:*  *(Step 1) Construct 5-7 section titles and if necessary, insert a few subsections under a section.*  *(Step 2) Populate 3~7 items in each section or subsection. (One item is for one paragraph.)*  *(Step 3) Describe one sentence(s) for each item. Note that all the sentences in a (sub) section should reflect on the connected and complete story of the (sub)section.* |

**1. Introduction**

- item 1 (for 1st paragraph) *(e.g. Trend, Motivation, Core ideas, Implementation, etc.)*

- item 2 (for 2nd paragraph)

- item 3

**2. Related Work** *(Two or three subsections are preferred.)*

**2.1. Subsection Title (of Related Topic 1)** *(e.g. Process Mining)*

- item 1 (for 1st paragraph) *(e.g. Introduction to process mining)*

- item 2 (for 2nd paragraph)

- item 3

**..**

**2.2. Subsection Title (of Related Topic 3)**

**…**

**3. Section Title**

**3.1. Subsection Title**

- item 1 (for 1st paragraph) *(e.g. Concept of HMM workflow)*

- item 2 (for 2nd paragraph)

- item 3

**..**

**3.2. Subtitle Title**

**...**

**4. Section Title**

**4.1. Subsection Title**

- item 1 (for 1st paragraph) *(e.g. Concept of HMM workflow)*

- item 2 (for 2nd paragraph)

- item 3

**..**

**4.2. Subtitle Title**

**...**

**?. Experiments**

**?. Conclusions**

|  |
| --- |
| *(Revised version of the email sent on February 17, 2014)*  *Dear All:*  *The format of paper outline is named the 3-7 system. In the system,*  *3 means three levels of paper structure:*  *- Section*  *- Subsection*  *- Paragraph*  *7 means the number of sections or paragraphs:*  *- One paper contains around 7 Sections.*  *- One section or subsections contains around 7 Paragraphs.*  *3 steps of this system are:  (<= modified)*  *(Step 1) Construct 5-7 section titles and if necessary, insert a few subsections under a section.*  *(Step 2) Populate 3~7 items in each section or subsection. (One item is for one paragraph.)*  *=> After Step 2, please send me for discussion!!*  *(Step 3) Describe one sentence(s) for each item (or paragraph). (Note that all the sentences in a (sub) section should reflect on the connected and complete story of the (sub)section.)*  *=> After step 3, you may start to actively write a paper by filling vacant parts of the paper.*  *It is only a guideline, but it is helpful when you prepare a research paper if you do not have so much experience in*  *From now, let us use this 3-7 system for preparing a draft of research paper.*  *Cheers,*  *Jae-Yoon Jung* |

**Sample of Paper Outline (*in case of Step 2*)**

*Recently modified by: Berny on: 2014.02.17.*

**Titles**

A Process Mining Technique for Resource Allocation Analysis Using Hidden Markov Chains

A Probabilistic Reasoning for Process Mining Using HMM to Discover Resource Allocation Patterns

**Table of Contents**

**1. Introduction**

*Motivation of this research*

*: Business process modelling, Role based allocation, process mining, etc.*

*Problem description*

*: Focused Problem of the paper*

*: Probability view point and comparison between Machine Learning and Process Mining*

*: Why we use HMM to solve the problem?*

*Goal of this paper*

*: The main objective…*

*Purpose of this paper*

*: In this paper, we …*

*Organization of this paper*

*:* *This paper is organized into the following sections. In chapter 2, chapter 3, etc…*

**2. Related Work**

**2.1 Process Mining for Resource Allocation**

*Brief introduction to process mining*

*: Process Discovery , Conformance Checking, and Enhancement Techniques*

*Introduction to Process Discovery Algorithms*

*Previous Studies Process Mining or Process Analysis for Organization Resource & Role-Based Allocation*

**2.2 Hidden Markov Models**

*Introduction to HMM & Baum Welch, and its various applications.*

*Related work of Markov Models in Business Analysis*

*Related work of Markov Models in Process Discovery*

**3. Process Mining Based on HMM**

**3.1. HMM-PM Algorithm**

*Concept of HMM workflow*

*Notation*

*Pseudocode*

**3.2. Mining of the Markovian States**

*Analysis of the Event Log*

*Typical Process Patterns and the Footprints they leave in the Event Log*

*Footprint HMM Matrix*

*Notation*

*States of the HMM workflow*

*Dummy State ε*

**3.3. Relating HMM-PM to Resources Allocation**

*Analysis of observations (Resources)*

*Dependency Relations*

*Analysis of frequency of events with resources*

*Dependency graph based in Markov states*

*Analysis of Initial Probabilities for HMM Workflow*

**3.4 Maximum Likelihood Estimation for HMM-PM**

*Introduction*

*: Effectiveness of the analysis with EM*

*Estimation of  from resources and activities*

*Estimation of β from resources and activities*

*Expectation – Maximization procedure from the estimated values*

*Trained Parameters for HMM workflow*

*Graphical representation of HMM workflow*

**4. Experiments**

**4.1 Experiment #1**

*Dataset of BPI Challenge*

*Phase 1 – Mining of the Markovian States*

*Phase 2 – Relating Resources to the HMM*

*Phase 3 – Maximum likelihood estimation for HMM workflow*

*Analysis comparison with other Models*

**4.2 Experiment #2 // I need first found a way for make this analysis**

*Dataset of BPI Challenge*

*Phase 1 – Mining of the Markovian States*

*Phase 2 – Relating Resources to the HMM*

*Phase 3 – Maximum likelihood estimation for HMM workflow*

*Analysis comparison with other Models*

**5. Conclusions & Future Work**