A DETECTION METHOD OF STAGNATION SYMPTOMS BY USING PROJECT PROGRESS MODELS GENERATED FROM PROJECT REPORTS

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Abstract: The purpose of this research is to extract "stagnation symptoms" from progress reports related to a research project. A stagnation symptom is defined in a portion where remarkable stagnation is seen during the progress of a project. Specifically, according to project managers, stagnation symptoms can be classified into the following three kinds: first one is a project bottleneck grasped from one document; the second is clarified by comparing it with the most recent document; and the third is clarified from changes to a working object in a series of documents. We propose a method of extracting stagnation symptoms using the structural analysis of a project's progress. A progress model that is a structural chart to expressing the progress of a project is generated from documents with label tags, which indicate prior contexts or attributes. This progress model has the following features: a multilevel layer model using detailed degrees and situation analysis using color, and relation analysis of these details and basis using color propagation. Stagnation symptoms are automatically extracted by applying stagnation symptom extraction rules to the progress model. This proposed method was been applied to a set of real progress reports. It could extract stagnation symptoms that were extracted manually.

1 INTRODUCTION

Research projects are planned and enacted at enterprises and universities every day. In progress of a projects, progress management greatly influences the success of a project(Takemoto, 2005; Sakthivel and Kalyanaraman, 1993). At this time, an enormous array of varied documents such as business daily reports, weekly reports, and progress confirmation minutes meeting are drawn up and circulated. To manage progress, management staff must examine all these documents(Paul and Khan, 1999; Kloppenborg and Petrick, 2004). If a project has some problems, they need to think about appropriate measures. However, looking for problem that is not necessarily described in an enormous number of documents requires a large amount of labor. Therefore, there is a strong need to develop a system that automatically extracts portions of a problem about the progress of a project from progress reports.

In existing research, a method that accumulates data, such as similar failure cases in the past, has been proposed and used for project management(Tsukuda and Morita, 2004; Y. Uchida and Tatebe, 2005). However, there is an assumption that data of similar cases in the past has been accumulated in this research. In any case, these methods are not effective if there is no such data.

In our research, a portion where remarkable stagnation is seen during the progress of a project is defined as a "stagnation symptom". Stagnation symptoms are extracted using the following method. First, label tags that show attribute information such as ID, work content, and so on are added to each sentence of an input documents. Next, a progress model that is a structural chart that expresses the progress of a project is generated from documents with label tags. Analyzing the structure of the generated model and applying stagnation symptom extraction rules to the progress model then extract stagnation symptoms.

2 STAGNATION SYMPTOMS EXTRACTION

2.1 Stagnation Symptoms

A portion where remarkable stagnation is seen in a project progress is defined as a "stagnation symp-

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tom". Figure 1 shows a typical example in which project managers consider stagnation symptoms when reading documents.

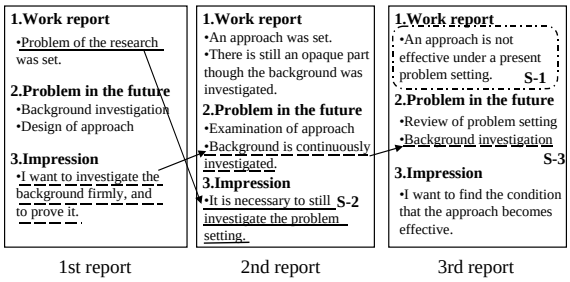

Figure 1: An example of stagnation symptom in a document group.

Stagnation symptoms are categorized into the following three kinds:

- One related to the fundamental aspects of project progress detected from one document. (cf. S-1 in Figure 1)
- One detected by comparing documents with the most recent document. (cf. S-2 in Figure 1)
- One detected from changes to a working object in a series of documents. (cf. S-3 in Figure 1)

In this research, the fundamental portion is defined as an important portion that is a fundamental part of a project's progress. On the other hand, the detailed portion is defined as a portion that describes fundamental contents in detail.

2.2 Stagnation Symptoms Extraction

In extracting the stagnation symptoms listed in the preceding section, the following problems occur:

- It is difficult to extract stagnation symptoms if documents are simply compared and analyzed using plain texts.
- It is necessary to judge whether a detailed portion is related to the fundamental aspects of the project's progress.
- It is not possible to use a method that uses a past failure case to extract stagnation symptoms if there is no failure case.

Therefore, we think that progress of a project should be modeled to solve problems listed above. This model is named the "progress model". Stagnation symptoms are extracted by analyzing the progress of the project with this model. The following functions are given for this progress model:

- A multilevel layer model using a degree of detail
- Situational analysis using color and relational analysis of details and fundamentals using color propagation
- The extraction of stagnation symptoms using rules

Thus, stagnation symptoms are extracted by the flow shown in Figure 2. First, "label tags" that show attribute information such as work content, ID, and pointers to a related sentence are added to each sentence for each meaning within an input document. A "progress model", which is a structural chart that expresses the progress of a project, is generated from a document with label tags. At this time, a target document with label tags and the most recent progress model are input. Adding information in the input document to the most recent progress model generates a new progress model. When the project starts, obviously the most recent progress model doesn't yet exist. Instead, a model generated beforehand is input. Next, we apply "color propagation", which analyzes colors used in the model to understand how a detailed portion influences fundamental portion. Finally, we extract stagnation symptoms by applying three stagnation symptom extraction rules to a progress model that has propagated color.

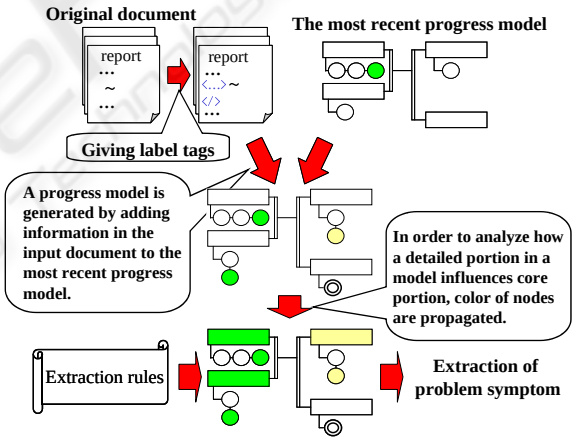

Figure 2: Flow of extracting stagnation symptom.

2.3 Definition of a Progress Model

In this model, the following two kinds of nodes are used to distinguish fundamental or detailed descriptions and to indicate project progress:

- Status node
  A fundamental node that shows the work procedure of a project that is given prior to a progress model being generated. This node is drawn in a rectangle, as shown in Figure 2.
- Label node
  This is a node that shows the detailed work for a

status node. This node is added by referring to a sentence of an input document. This node is drawn in a circle, as shown in Figure 2.

The status node is a superior position node indicating the fundamental portion of project. On the other hand, a label node is given as a subordinate position node of a status node.

Steps in a project progress such as “research purpose” and “approach” are written in the rectangle of a status node. The sentence number of an input sentence is written in the single circle of a label node. In addition, a label node to a current work is drawn with a double circle.

Labels are painted in four different colors according to a content of the target sentences, for instance, “red” is remarkable stagnation in the project’s progress. Other colors are “white” as not-processed, “green” as no stagnation, and “yellow” as more inspection.

The model has two axes: The “description level axis”, which is vertical and the “time axis”, which is horizontal. A “description level axis” shows that near a status node is fundamental and distant from a status node is detail. Figure 3 shows a graphical representation of nodes.

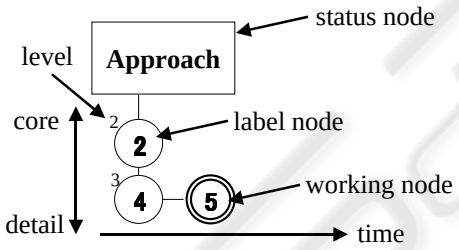

Figure 3: Example of writing status node and label node.

If some processes are worked in parallel, they are shown by two lines as an “AND connection”. On the other hand, if some processes are worked in an alternative manner, they are shown by one line

2.4 An Extraction Method that Uses Stagnation Symptom Extraction Rule

After generating a progress model and propagating color, stagnation symptoms are extracted. There are three kinds of stagnation symptoms as described in Section 2.1. In order to extract these stagnation symptoms, the following three rules are used:

2.4.1 A Rule that Extracts Stagnation Symptoms Related to the Fundamental Elements of Project’s Progress

This stagnation symptom is extracted by analyzing one progress model. Specifically, if the color of a status node connected with a series or an “AND connection” in a target progress model is red, it is thought that stagnation symptoms related to the fundamental elements of project’s progress exist, as shown in Figure 4. Thus, a sentence in a label node that causes a status node to be red using color propagation is extracted as a stagnation symptom. This extraction rule is defined as rule 1.

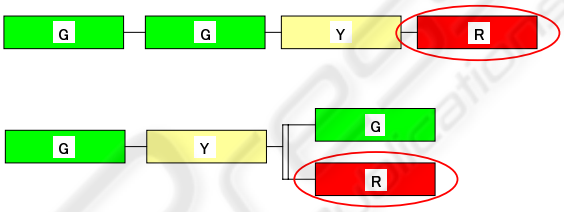

Figure 4: Example of stagnation symptom by rule 1.

2.4.2 A Rule that Extracts Stagnation Symptoms Detected By Comparing the Most Recent Document with a Target Document

This stagnation symptom is extracted by comparing the color of a target progress model’s status node with the color of the most recent progress model’s status node. There are two cases. The first case is an occasion when progress is not seen, such as from white to white or yellow to yellow. The second case is an occasion when state has deteriorated, such as from green to yellow. We think that stagnation symptoms exist at the portion that corresponds to these cases’ as shown in Figure 5. Thus, a sentence in a label node that causes the color deterioration of a status node is extracted as a stagnation symptom. This extraction rule is defined as rule 2.

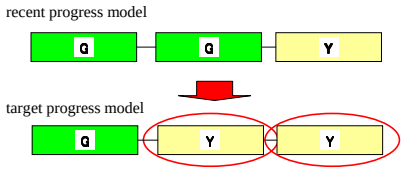

Figure 5: Example of stagnation symptom by rule 2.

2.4.3 A Rule that Extracts Stagnation Symptoms Detected From the Changes of a Working Target In a Series of Documents

This stagnation symptom is extracted by seeing the position and situation of a working node in a target

progress model and past progress models. Specifically, when no progress can be seen in a working node in a past progress model, it becomes a stagnation symptom as shown in Figure 6. So, in a target progress model, a case where a working node is connected to the lower side or right side of working node in a past progress model is a target of this rule. If the color of the working node is any color except green, a sentence in the last working node is extracted as a stagnation symptom. This extraction rule is defined as rule 3.

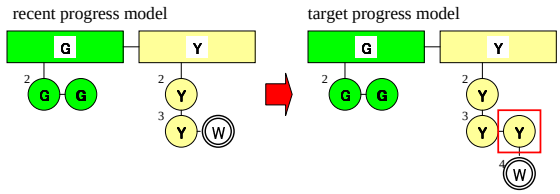

Figure 6: Example of stagnation symptom by rule 3.

3 EXPERIMENTAL RESULTS

We applied the proposed method to an actual failure case in a research project at university, and extracted stagnation symptoms. The data of the input documents used in the experiment are as follows:

- Kind of document: Regular progress report
- Style of report: One A4 size paper
- Volume: five sheets

In this experiment, stagnation symptoms extracted with the proposed method are compared with ones taken by hand. Figure 7 shows a generated progress model and portions where stagnation symptoms were extracted.

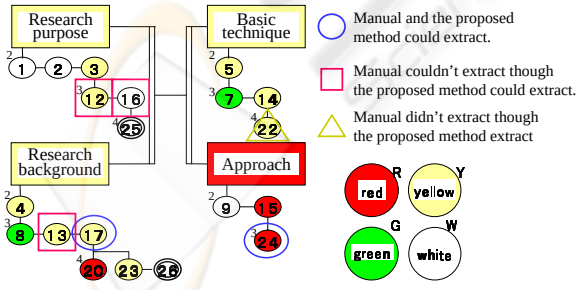

Figure 7: The extracted stagnation symptoms from the progress model.

Some of extracted sentences are shown below.

- Manual operation and the proposed method extracted the following elements:
  - "It is necessary to design other approaches." Portion: The fourth sheet, Rule: rule-1
- The proposed method extracted the following elements that manual operation could not extract:
  - "Differentiation with existing research" Portion: The third sheet, Rule: rule-3
- The proposed method extracted the following elements that manual operation didn't extract:
  - "There is repetition with the product trend key word" Portion: The fourth sheet, Rule: rule-2

The proposed method could extract three stagnation symptoms that the manual operation couldn't. These were the stagnation symptoms detected from situation changes in the past, so the manual extractor had overlooked these stagnation symptoms. A portion that the extractor judged weren't stagnation symptoms were extracted by the proposed method.

4 CONCLUSION

From the results of the evaluation experiments, we believe that it is possible to extract stagnation symptoms from actual progress reports.

The following areas are our future work:

- Automatically adding label tags to the input document data.
- Introducing the importance degrees of the stagnation symptom

As for the automatic addition of the label tags, if input progress reports are assumed to made with a predefined format, we think that the label tag can be added by reading words and analyzing the layered structure of the sentences.

The proposed method figures out whether there are stagnation symptoms or not. However, there are different degrees of stagnation symptoms. Thus, we think that we need degree of importance to judge the extracted stagnation symptoms as numerical values.

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