DOC 1 : Business Analysis Method for Constructing Business–AI Alignment

This text emphasizes, the system **development projects using AI technology application programming interfaces**. The developers can use the **module functions** by preparing the training data required for the machine-learning programming module. Business offices have started to incorporate AI technologies to support office-type activities, such as inquiry services that operators answer queries about business operations, products, and services or screen operations using documents and all of these functionalities has been made available as APIs. There are nine reasons why machine-learning projects fail and it is related to project management-related issues. This paper is focus on the **project design phase before starting such a PoC project and consider a consensus of the AI system development project between the business and IT divisions**.

Model representing a project developing an AI service system. An architecture for representing a whole system is needed in a practical project applying big data analytics or machine-learning technologies. Some system evaluation issues should be solved when realizing prediction algorithms such as machine-learning technologies **as a practical social system**. In particular, it is important to assess a project **by combining the business goal, the business process, and the developed application.**
It is important to **prepare generic models** for each application domain or each industry.
For example, for business–IT alignment by enterprise architecture were proposed in the IT system operation management domain and IT system risk management domain. It is developed using **ArchiMate**, which is a common **EA modeling language**. The text underscores the need for developing a method to construct project-specific business-AI alignment models from generic ones.

Three business concepts and three application concepts defined in **ArchiMate** to represent a project developing a system using AI technologies :
- Business **service**: an explicitly defined exposed business behavior.
- Business **process**: a sequence of business behaviors achieving a specific outcome.
- Business **object**: a concept used within a particular business domain.
- Application service: an explicitly defined exposed application behavior.
- Application component: an encapsulation of application functionality aligned to the implementation structure.
- Data object: data structured for automated processing.

This EA modeling approach, represent a **practical AI service system project** in which we develop a system containing **AI technologies for an enterprise function**. In an office, employees conduct various intelligent activities. To use machine-learning technology for system development, **we need to define options in the target business domain and collect example inputs assumed for each option**. The model is **generated from training data containing such pairs of options and examples.** This model is **deployed into a runtime machine-learning engine**, which **obtains input data and provides output data using the model (Prediction)**. This system, called the **AI service system**, is illustrated using the **EA modeling approach.**

In requirement modeling, a table containing concerns, problematic situations, cause analysis, target system to be developed, and solution is proposed to analyze the business under consideration. We analyze a business in which we apply AI technologies from two viewpoints : business level and service design level.

- **(ASOMG)** : actor, service, objects, means, and goal are identified as **key elements (KSF =Key success factor)** for representing a business service. The table is introduced to **design business models**.
- **ASOGA table = ASOMG + assessment,** defined as key elements for **AI service systems**.

Case Study of a major Japanese bank
A method for constructing a project-specific business–AI alignment model. Confirm that :
- Project-specific business–AI alignment model **can be constructed through the business analysis**.
- Project members can construct a project-specific model without deep knowledge on AI technologies.

More than 10,000 transactions in the **overseas remittance (OR)** business each month. For each transaction, need to understand **the recipient from the natural-language text** in the application document and determine the **destination information on the basis of the bank's own business rules**.
In the OR business division, one of the business goals is to **reduce the cost**. The OR business is conducted in the foreign exchange business division. In the business and service design level views are determined.

There are some candidate solutions for reducing the average time for an OR business transaction. From these candidates, we select a destination decision service and derive that we can use a machine-learning-based named entity extraction (**NE Ext**) technology.

To use the **ASOGA tabl**e, we need :
- **identify the application service related to the KSF at the user level**.
- investigate the proposed method through application to real projects in various business domains.

We can construct a project-specific business–AI alignment model from the generic model by using the proposed business analysis method, without requiring any support of data scientists in the business analysis.
- **we confirm the following two research hypotheses.**
- we describe a destination information extraction service using the **NE Ext technology** for realizing the destination decision service from its input and output data, with some industry examples. When identifying such AI technologies for realizing new business services,
- Need to know their possible candidates and the capabilities in advance. This can be solved **by preparing an AI technology catalog (e.g., API documents) with the input, output, and capability of each AI technology.**

The study, constructed a model for representing an AI service system project. For developing a system using AI technologies, to support a business task in a company, it is important that all the teams have common understanding of the project before starting it. For this purpose, a business– IT alignment model for AI service systems was proposed as a **business–AI alignment model**, we needed to substantiate this model for each project because it is a **generic model**. To solve the problem, a method is proposed for constructing the business–AI alignment model. In this method, two types of problem **analysis tables and ASOGA table** by extending the existing business analysis table used in the requirement analysis and business modeling, and proposed steps for filling cells in these tables.

DOC 2 : AI Trust in Business Processes: The Need for Process-Aware Explanations

Business processes underpin a large number of enterprise operations : loan origination, invoice management, and insurance claims processing. Opportunity for infusing AI to **reduce cost or provide better customer experience**. Innovations (such as clusters of process traces, predict outcomes, and recommend decisions, deep learning models including from the NLP domain) are not really adopted by companies, and those adopted are limited to narrow domains such as customer services, enterprise risk and compliance.
Challenge : the BPM community to **build on the AI interpretability literature, and the AI Trust community to take advantage of business process artifacts**.

Loan application process in Fig. 1. Suppose we build a sequence model that takes as input the activities and features observed in the process and predicts the outcome, in this case whether a loan will be approved. Such models have been shown to achieve accuracies of up to 85%.
(Fig. 2) LIME will explain the prediction based on sampling perturbations around the input features and measuring how the predictions change with the perturbations. And suggests that the presence of the skilled agent activity causes the application to be rejected.

Causal relationship that can be inferred from the process description: the LOAN AMOUNT and/or CREDIT SCORE features are the cause of the feature associated with the skilled agent activity.
Once causal relationship is applied above to constrain the perturbation sampling, LIME offers the explanation (**Fig. 3)** where the **CREDIT SCORE** is now prominent.
The example illustrates how directly applying interpretability techniques to process models results in incomplete or potentially misleading explanations and how by being process-aware we can augment existing algorithms to improve the quality of explanations.

(Fig. 4) Virtually all AI models in the BPM literature train models with features from process traces, depicted as “state of the art”. There is an opportunity to apply known interpretability approaches in a BPM context as **LEVEL 1**. Ex : a regression model to predict process completion time can be augmented by techniques to make regression models more interpretable. The same can apply to **deep learning models** for process prediction tasks. Most of the current techniques, are based on **sequence models.** LEVEL 1 only uses the trained model (either as a black box or white box) and possibly features from the training data, at least offers researchers a pathway to begin experimenting.

LEVEL 2 Bring *process-awareness* to the problem. **Interpretability models** would take advantage of the knowledge of the business process definitions and full runtime process traces. Some of the information in these **artifacts** is lost when preparing the data for the predictive models. **Standard techniques may not be appropriate for business process**. **Process-aware explanations** is an interesting research area with potential for **high business impact.**

Figure 1: Example loan application business process

Figure 2: Vanilla LIME: The explanation is incomplete showing only that the loan is rejected because it is sent to a skilled agent.

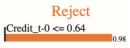

Figure 3: Process-aware LIME: The explanation now highlights the influence of the causal CREDIT SCORE feature.

Figure 4: Approaches for interpretability in BPM AI models

DOC 3 : Automated business process management – in times of digital transformation using machine learning or artificial intelligence

This research looks in detail at the possibilities of using machine learning or artificial intelligence for Business Process Management in times of digital transformation. The paper aims to explore their application in BPM, assessing their impact, advantages, and drawbacks for process steering and optimization.

The first steps of the current industrial revolution (digitalization) is mainly due to these factors : the implementation of mechanic production over the division of labour and assembly line work to the usage of electronic and automatic production. Behind the concepts Smart Factory, Internet of Things, intelligent manufacturing, Cloud Computing, Big Data, Machine to Machine communication and many more, new elements and trends affect the established economy.

- Cloud computing is hosted on the internet and allows remote access to apps, services, and stored to manage processes, workflows or machines.
- Industry 4.0 takes processes and the management of processes which are usually managed internally by people into the cloud where they can be adapted and analysed from anywhere.

Process management and automation play a major role in the supply chain and new customer requirements in order to reduce response time, to avoid back logs, dissatisfied clients and processing errors. The opportunity of independent process management, via automated and learning computer programs promises in theory agility, flexibility and automation for a whole company as well as the process stakeholders.

The results of the **shadowing** show two main findings:

1. the participants estimate their use of BPM and automated process management better than it is in reality
2. approximately 45% of the compiled data from the companies are not used or controlled effectively

Big Data and data lakes are used in the business but the reporting and data analysis can be enhanced. Deep learning, machine learning and AI can be named as a recommendation to automate and optimize the process and they support the BPM through new algorithms and independent learning via constant data analysis.

The methods of "deep learning" with neural networks are always meant when artificial intelligence is mentioned. Furthermore the rising amounts of data which are important for the initial training of the neural Networks have positive effects. After initial training, the "deep learning" of the procedure consists in always learning during the running application, which increases the recognition accuracy and results. From this can be deducted that next to the algorithm the big data plays a significant role for the deep learning and thus for the artificial intelligence.
A survey and shadowing of digital companies were conducted to assess the feasibility of using machine learning or AI for automated process optimization. Based on the analysed facts and the AI approach a recommendation was announced to the survey participants and their companies for automated process optimization with machine learning or AI.

Time-intensive manual workflows, based on e-mail, Excel or well and truly paper work reduce the productivity of companies. Targeted and consistent process automation is essential for companies and so is using the power of data and to make smart and profitable decisions.

DOC 4 : Business Process Modelling and Design : Models and Methodology

AI can provide both the enabling technology for representing and automatically reengineering processes and tools to support process redesign. This paper present a **formalism** to represent **knowledge about organisations and their business processes**. The paper emphasises the use of AI techniques for representing knowledge about organisations and their processes. They use the logic programming language ConGolog for representing knowledge about organisations and their processes. This paper presents a methodology which can be used by an enterprise that wishes to develop a new business process, or alternatively model, document and analyse formally an existing process.

This paper represent enterprise knowledge using an “extension of the formalism” of situation calculus. This formalism has been designed especially for knowledge representation and reasoning in dynamically evolving domains. The goals are associated with the following components of other submodels :

- **Roles and actors (organisational submodel)** : Goals are assigned to roles as a matter of policy. Organisational goals become responsibilities of roles and the actors playing these roles.
- **Processes (process submodel)** : The purpose of a process is the achievement of one or more goals. Explicit capturing of enterprise goals is important because it allows us to study organisations and their processes from an intentional point of view.

This enables us to represent type of information. Organisational goals can be reduced into alternative combinations of subgoals by using AND/OR goal graphs originally introduced in the area of problem solving. The notion of **goal reduction** is used, to define the concept of organisational **objective**.

Goal : is a desired state of affairs many concrete and formal goals can be formalised as sentences. It should be described only informally, and reduced step by step to more concrete and formal goals. **Goals** can influence positively or negatively other goals and interactions between them must be noted explicitly to facilitate goal-based reasoning.

A good process model should allow representation of "what is going to be done, who is going to do it, when and where it will be done, how and why it will be done, and who is dependent on its being done. Is not include a spatial attribute for processes and we do not consider dependencies explicitly. **The main concepts of the process submodel are: action, process, role, actor and goal** and is connected to the organisational submodel through the **concepts of actor and role**. All actions carried out as part of a process are executed in the context of an organisational role by an actor playing that role. **The process submodel** is related with the **objectives and goals submodel**: processes are operationalisations of organisational goals. **Process submodel** is built around the **concepts of situation calculus** and the logic programming language **ConGolog**. The situation calculus is a first-order language for representing dynamically evolving domains.

- A **situation** is a state of affairs in the world we are modelling. Changes are brought to being in situations as results of actions performed by actors.
- An **action** is primitive if no decomposition will reveal any further information which is of interest. Actions are distinguish actions into **causal and knowledge-producing**. This concept corresponds to the notion of **external event** in other process frameworks.

Exogenous actions are necessary in an enterprise modeling framework since they allow us to "**scope**" our modeling and consider certain parts of the enterprise (or its environment) as being outside of the area we are modelling. It can also be handled by the situation calculus formalism.

- **A business process** : a network of actions performed in the context of one or more organisational roles in pursuit of some goal.

An expression of the following form :

- the **concepts submodel** information about enterprise entities, their relationships and attributes information in this submodel is formally expressed by sentences of L using appropriate predicate and function symbols.
- **The constraints submodel** is used to encode restrictions imposed on the enterprise. Constraints can be formally expressed by sentences of L using the machinery of the situation calculus and the symbolsdefined in the rest of the submodels. Constraints can be static or dynamic.

The **methodology** starts with the objectives of the enterprise concerning this new development and produces a detailed formal specification of a business process which achieves these objectives. The formal specification is developed as **a set of submodels** that capture the new process from various viewpoints. The steps of the proposed methodology are the following:

- Identify the organisational objectives and goals. Initiate goal reduction

- Identify roles and their responsibilities.
- Match goals with role responsibilities. For each role specify its primitive actions, the conditions to be noticed and its interaction with other roles.

Develop role-specific **ConGolog** procedures to fulfill responsibilities efficiently for **business process modeling**. The methodology is applicable for both **new process specification and formal modeling of existing processes**. The concepts of **goals**, **actors** and **roles** in enterprise modeling (and requirements modeling) is emphasized by ConGolog

This paper is also related to the **enterprise modeling frameworks of** Enterprise Knowledge Development **(EKD)**. In EKD an organisation is partitioned into the following submodels : **the goals submodel** (objectives and goals submodel), **the actors and resources submodel** (organisational submodels), **the business processes submodel**, **the concepts submodel**, **the business rules submodel**, and the technical components and requirements submodel. In terms of **formalisms**, EKD uses entity-relationship models to represent structural information and Role-Activity Diagrams to represent roles and their activities.