The DFG funded project deals with intelligent design assistants for the early concept phases in architectural design. The aim is to develop methods for generating proposals (extensions to the design, alternative design configurations) on the basis of existing designs.

**How architect proceed.** This IDP investigates sequential design process models during the room configuration phase in architecture, specifically the artificial intelligence methods for the recommendation of continuation of the current design direction. Using recurrent neural networks (RNN) of deep learning models the previous design actions taken by the architect are to be evaluated and used as a query to the contextually suitable neural network to get the most probable next action.

**Objectives:**
- Familiarisation with existing Java & Python-based framework as the theoretical basis for AI-based support in early design phases
- Development of advanced graph-based data structure for recording actions/events during design process based on actions assigned into coherently grouped sequences (optional: model for grouping provided)
- Further development/adaptation or new development of TensorFlow-based RNN for grouped design step sequences and prediction of next action in a query sequence
- Development of methods for synthesis/generation of dataset consisting of sequenced data structure entities to train RNN
- Development of methods for segmentation of dataset and to get contextually suitable predictions
- Further development / adaptation of methods for selection of proper neural network for querying

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WHAT ARCHITECTS DRAW. This IDP looks at hand drawing as a possible candidate for intuitive interaction with an intelligent Computer-Aided Architectural design (CAAD) system. A challenge for the realisation of sketched-based interaction is for computers to recognise what the designer is drawing. To inform the development of effective methods for the RECOGNITION of semantic building information in schematic layout sketches a better understanding of HOW designers encode this information in sketches is required.

- Research architectural drawing elements and representations/symbols
- Research segmentation and classification methods/metrics of hand-drawn works, e.g. sketches, handwriting
- Define rules for classification of drawing elements
- Develop and implement classification and labelling approaches
- Free choice of programming language and platform

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WHAT ARCHITECTS MEAN. This IDP looks at hand drawing as a possible candidate for intuitive interaction with an intelligent Computer-Aided Architectural design (CAAD) system. An understanding of what is going on in the designers’ minds during the design process provides a basis for shaping the dialogue between the CAAD system and the designer. To inform the development of effective methods for the INTERPRETATION of semantic building information a better understanding of WHAT information designers encode in sketches is necessary.

CONTEXT:
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TOPIC:
WHAT ARCHITECTS MEAN. This IDP looks at hand drawing as a possible candidate for intuitive interaction with an intelligent Computer-Aided Architectural design (CAAD) system. An understanding of what is going on in the designers’ minds during the design process provides a basis for shaping the dialogue between the CAAD system and the designer. To inform the development of effective methods for the INTERPRETATION of semantic building information a better understanding of WHAT information designers encode in sketches is necessary.

OBJECTIVES:
• Research relevant metrics/methods/algorithms, e.g. signature recognition, segmentation of hand-drawn sketches
• Evaluation of applicability and adaptability
• Apply (and/or Adapt) selected methods on labelled drawings
• Free choice of programming language and platform
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**How Architects Design.** This IDP looks at hand drawing as a possible candidate for intuitive interaction with an intelligent Computer-Aided Architectural design (CAAD) system. An understanding of which activity of the design process the designer is currently working on, offers the opportunity to understand the user and the specific workflow. To inform the development of effective methods for the interpretation of semantic building information a better understanding of what meaning the encoded information reveals about the current state of the architect’s design process.

**Objectives:**
- Research relevant metrics/methods/algorithms, e.g. signature recognition, segmentation of hand-drawn sketches
- Research architectural workflow and design process
- Define rules for classification of drawing actions
- Develop and implement classification and labelling approaches
- Free choice of programming language and platform
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**Context:**
The DFG funded project deals with intelligent design assistants for the early concept phases in architectural design. The aim is to develop methods for generating proposals (extensions to the design, alternative design configurations) on the basis of existing designs.

**Topic:**
How to support architects. This IDP investigates semantic building models as a basis for the realisation of use cases, e.g., retrieval of reference designs from design databases, automatic generation of design variants or auto-completion of partial designs. To inform the development of effective methods for the representation of suggestions and additional design decision support, a better understanding of how the architects need to have the suggestions provided is sought.

**Objectives:**
- Research relevant representation methods, e.g., architectural workflow, auto-completion suggestions, XAI facilities
- Evaluation of applicability and adaptability
- Develop UI prototype for design application
- Free choice of language and platform
- Tools for mixed reality (e.g., HTC Vive, Oculus Quest) available

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WHEN TO SUPPORT ARCHITECTS. This IDP investigates semantic building models as a basis for the realisation of use cases, e.g. retrieval of reference designs from design data bases, automatic generation of design variants or auto-completion of partial designs. To inform the development of effective methods for the POINT IN TIME for the individual suggestions and additional design decision support, a better understanding of WHEN AND WHICH the suggestion the architects is needed.

OBJECTIVES:
- Research relevant segmentation methods of act of drawing
- Research relevant markers in sketches (e.g. pressure, time between pen-on-paper)
- Evaluation of applicability and adaptability of methods
- Develop algorithm for timing suggestion and its type
- Free choice of language and platform

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