



Software für Statik und Dynamik

www.dlubal.com



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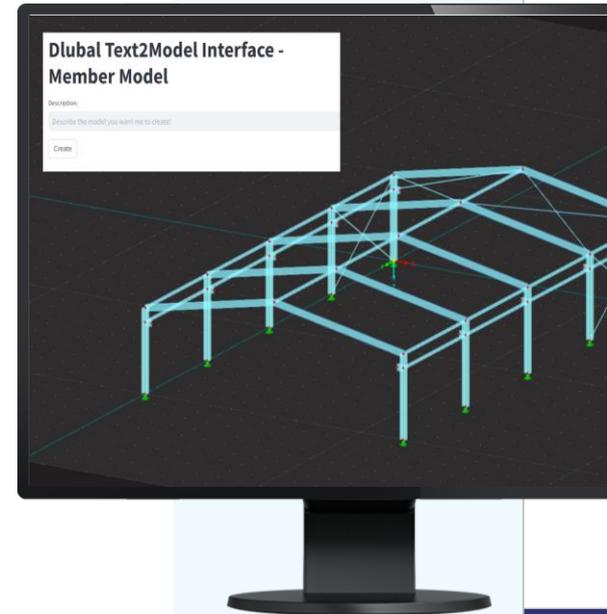


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Webinar

Integration von KI mittels API in RFEM



Fragen während der Präsentation



GoToTraining-Bedienpanel Desktop



E-Mail: info@dlubal.com



Bedienpanel ein- oder ausblenden

Audioeinstellungen anpassen

Fragen stellen

Audio

Sound Check ?

Computer-Audio
 Telefonanruf

STUMMGESCHALTET

Mikrofon (Plantronics C310)

Lautsprecher (Plantronics C310)

Sprecher: Andreas Hörold

Fragen

[Frage an Mitarbeiter eingeben]

Senden

Webinar-ID: 109-458-163

GoToWebinar



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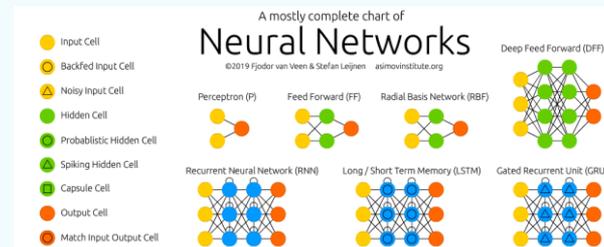
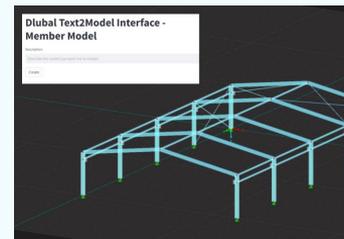
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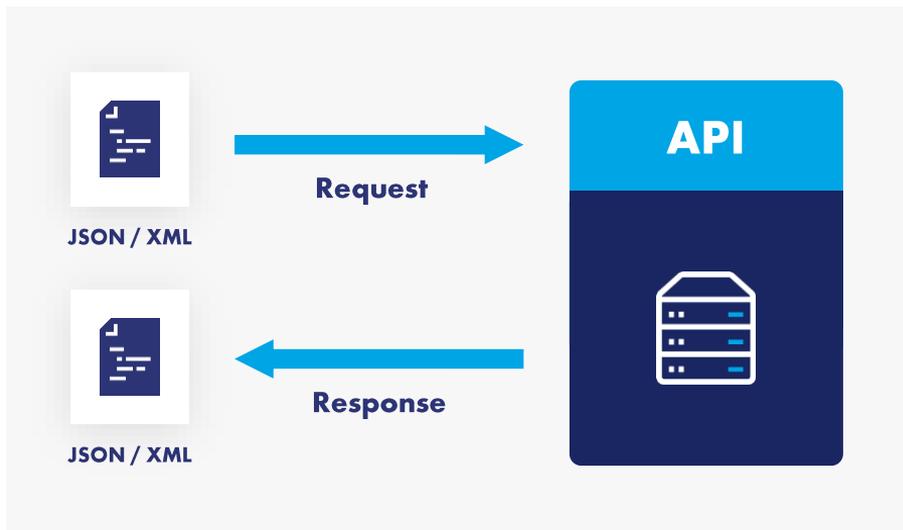
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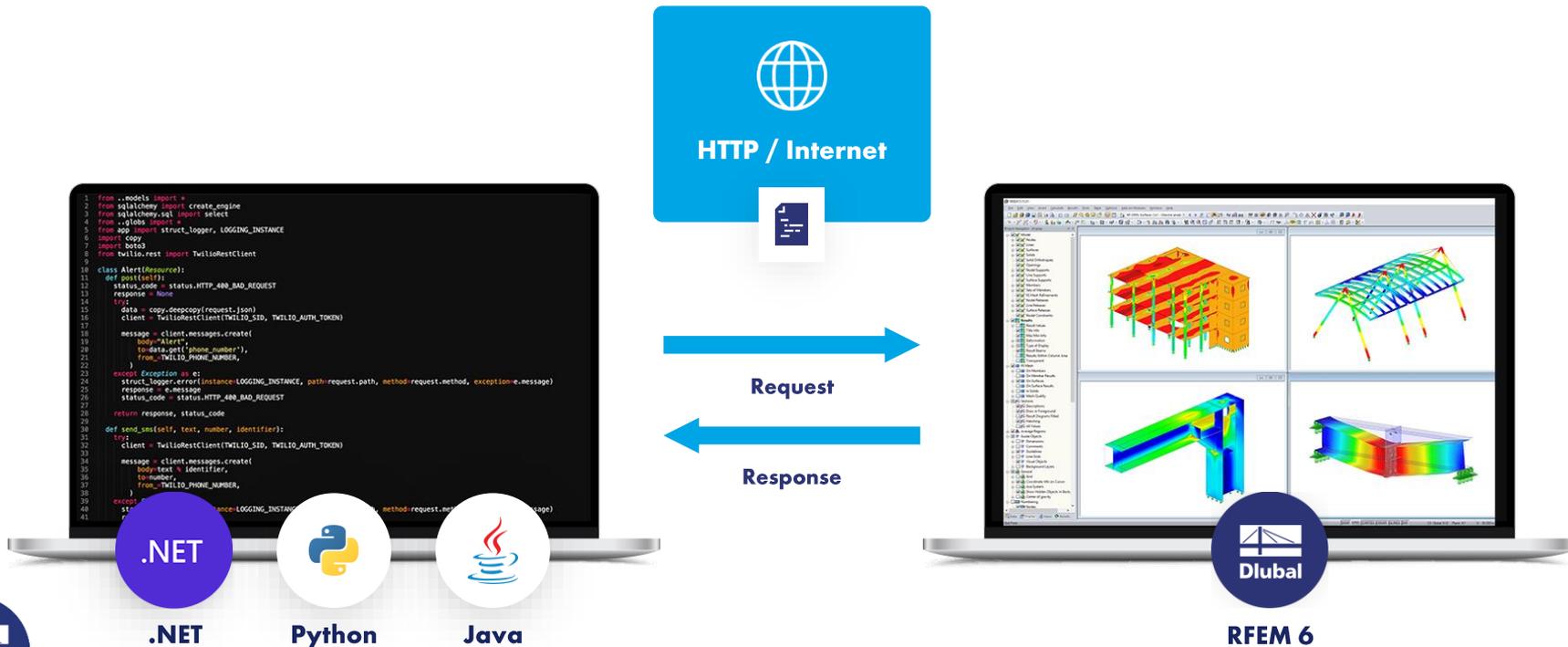


Was ist eine API?





Was sind Webservice?





Das Dlubal github repository

The screenshot shows the GitHub profile for Dlubal-Software. The profile includes a blue square logo with a white bridge icon and the word "Dlubal". The name "Dlubal Software" is displayed, along with the description "Structural Analysis and Design Software | RFEM | RSTAB". The profile has 61 followers and is located in Prague. It lists the website "http://dlubal.com", the Twitter handle "@dlubal_en", and the email "api@dlubal.com". A "Verified" badge is present. The profile is followed by a "Follow" button.

The main content area shows a README file named "README.md". The content of the README includes the text "Dlubal Software GmbH" and a large circular logo with the bridge icon and the word "Dlubal". Below the logo are social media links for GitHub, LinkedIn, Instagram, and the website. There are also badges for "RFEM v6.0", "RSTAB v9.0", and "RSECTION v1.0".

The "Welcome" section of the README reads: "We are glad that you visited our Dlubal's company GitHub. We are publishing our open source libraries developed in Python & C# for Webservice. We are also publishing open source libraries which we have used for development of our commercial applications and we did some modifications."

On the right side of the repository page, there are sections for "View as: Public", "Top discussions this past month", "People" (a grid of user avatars), and "Top languages" (C++, Python, C#, C, HTML).

<https://github.com/Dlubal-Software>





Einfaches Beispiel zur Nutzung der Webservices

The image shows a dual-pane window. The left pane is a code editor with a Python script for a simulation. The right pane is a 3D model viewer showing a rectangular columnar structure with a red arrow pointing to its top surface.

```

1 columnar.py
2 from HFM.InitModel import Model, Calculate_all
3 from HFM.BasicObjectMode import Mode
4 from HFM.BasicObjectSection import Section
5 from HFM.BasicObjectMember import Member
6 from HFM.TypeOfMemberModelSupport import ModelSupport
7 from HFM.Enum import ModelSupportType, ModelSupportDirection, CheckObjectType
8 from HFM.LoadCaseAndConditions.StaticAnalysisSettings import StaticAnalysisSettings
9 from HFM.LoadCaseAndConditions.LoadCase import LoadCase
10 from HFM.LoadAndModel import ResultList
11 from HFM.Result.ResultTable import ResultTable
12 import json
13
14 sectionList = ["FE 00", "FE 100", "FE 120", "FE 140", "FE 160", "FE 180",
15              "FE 200", "FE 220", "FE 240", "FE 260", "FE 280",
16              "FE 300", "FE 400", "FE 420", "FE 440", "FE 460", "FE 480"]
17
18 Model("New, 'columnar'")
19 resultDict = {}
20 for section in sectionList:
21     Node(1,0,0,0)
22     Node(1,0,0,0)
23     Node(1,5,0,0)
24     Material(1, "S10")
25     Section(1, section, 1)
26     Member(1, 1, 2, 0, 1, 1)
27     ModelSupport(1, 1, ModelSupportType.FIXED)
28     StaticAnalysisSettings()
29     LoadCase(1, "LOAD", [False])
30     ModelDir(1, 1, 2, ModelDirDirection.DOWN_DIRECTION, 0.0001, 0.0001, 1000)
31     Calculate_all()
32     deformationResult = ResultTable.ResultTableFormat(CheckObjectType.OBJECT_TYPE_LOAD_CASE, 1, 2)
33     resultDict[section] = deformationResult[0] * displacement_absolute * 1000
34
35 Model.closeModel.service.delete_all()
36
37 import json
38 with open("results.json", "w") as fp:
39     json.dump(resultDict, fp)

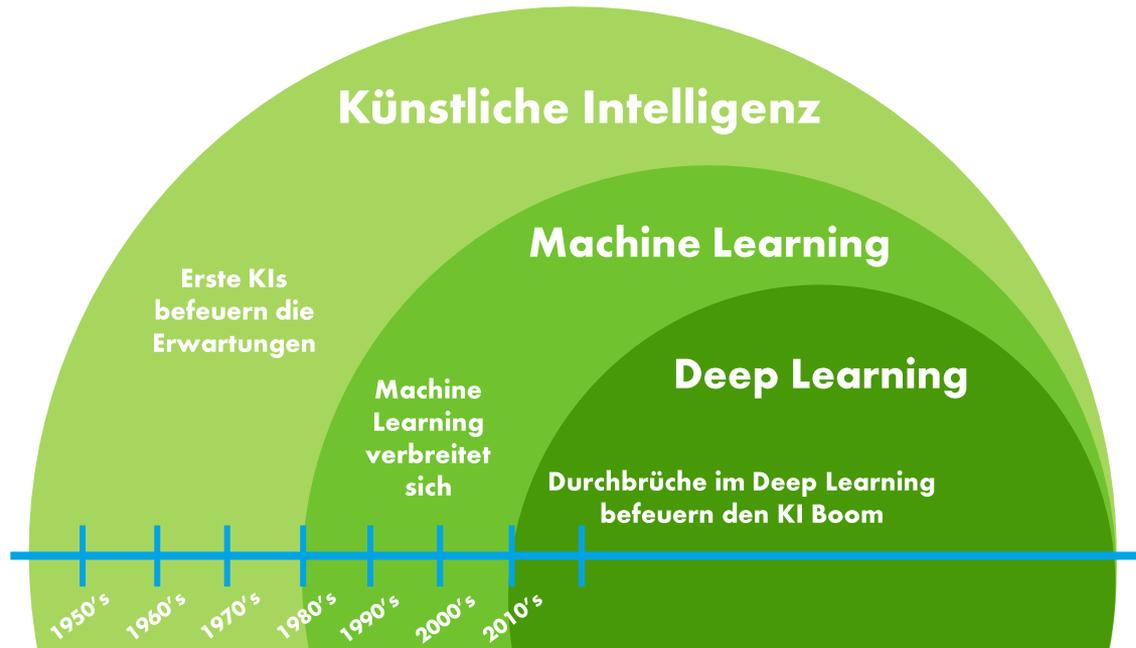
```

The 3D model viewer shows a perspective view of a rectangular columnar structure. A red arrow points to the top surface of the structure. The viewer includes a navigation toolbar and a material list table.

Material	Name des Materials	Material	Material	Elementarbereich	Schubmodul	Querdehnung	Span. Grenzw.	Dichte	Wärmedehnkoeff.	Extensor
1	S10	Stahl	Stahl (linear elastisch)	1.00000	0.7691	0.000	75.50	10000.0		
2										
3										
4										

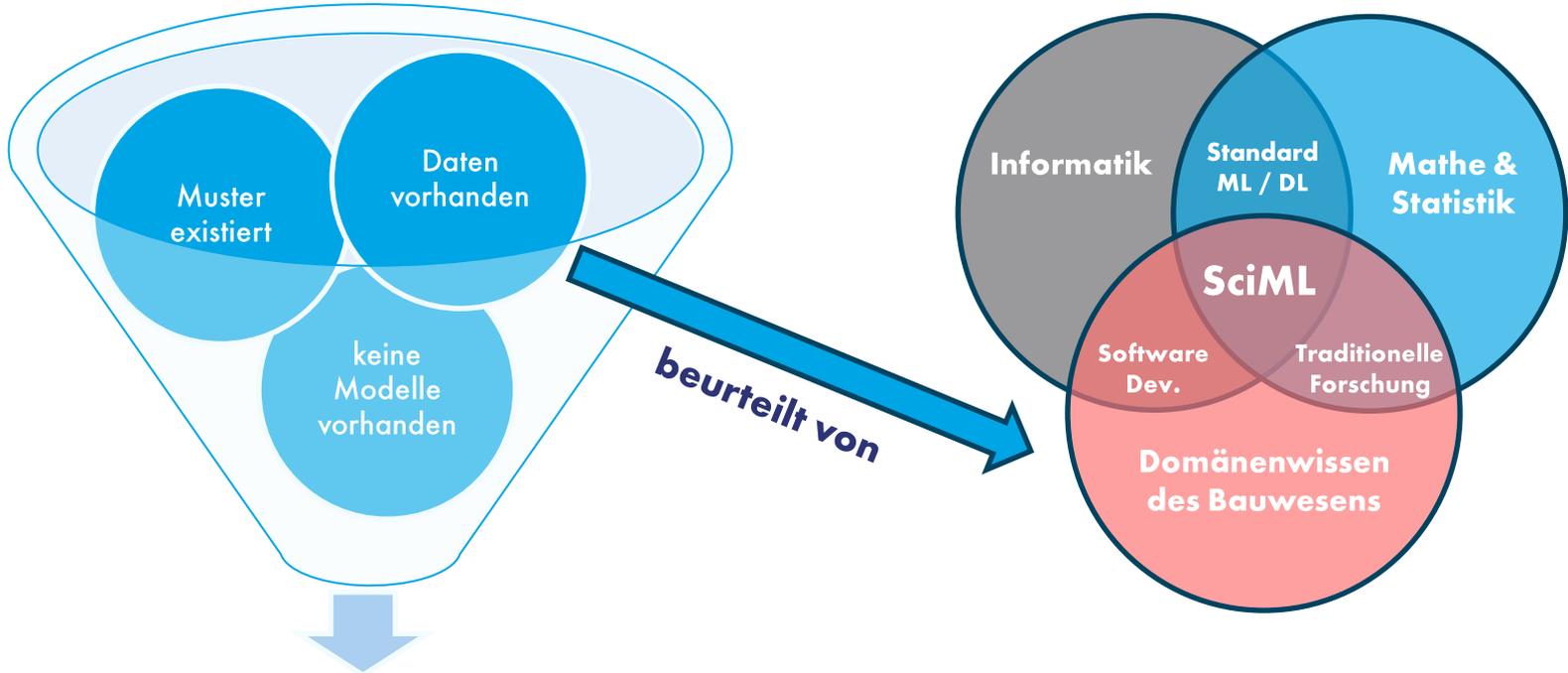


Was ist Künstliche Intelligenz (KI)



Adaptiert nach: https://miro.medium.com/max/639/1*U0H9Af2FT-DK0nnHhaoJQ.png

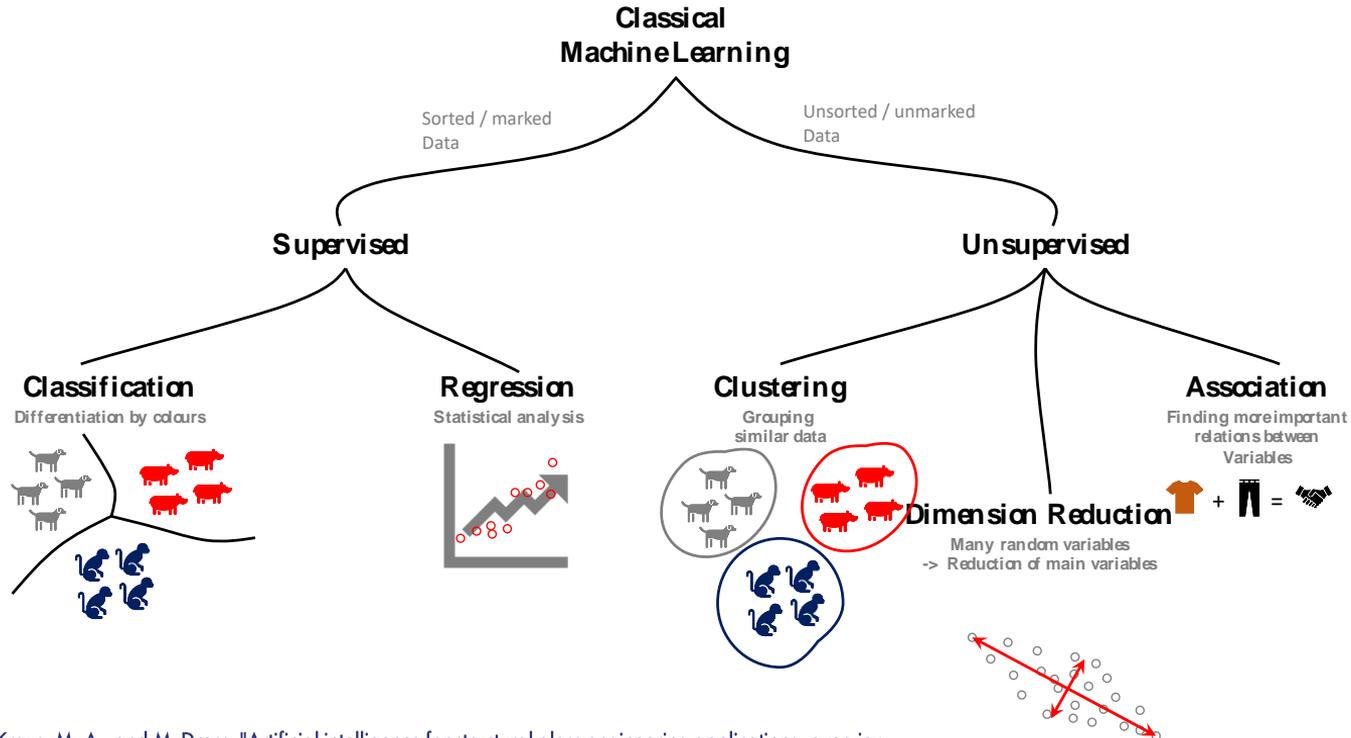
Zutaten der Künstlichen Intelligenz (KI)



notwendige Voraussetzungen für
den (sinnvollen) Einsatz von KI

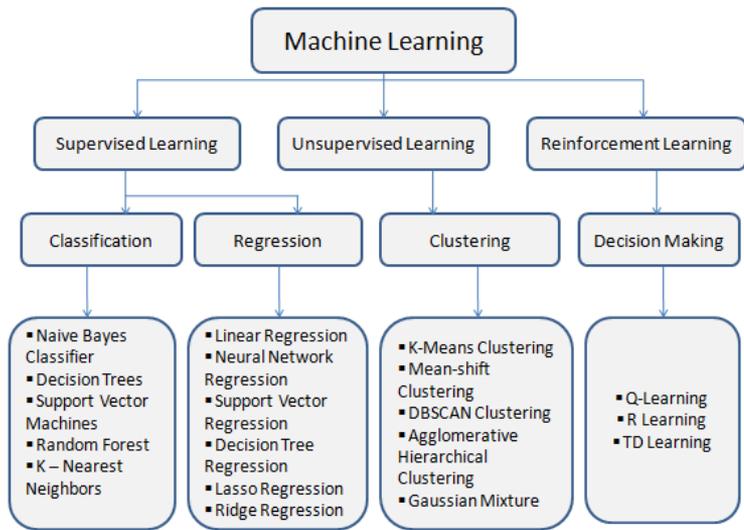


Algorithmen des Machine Learning (ML)

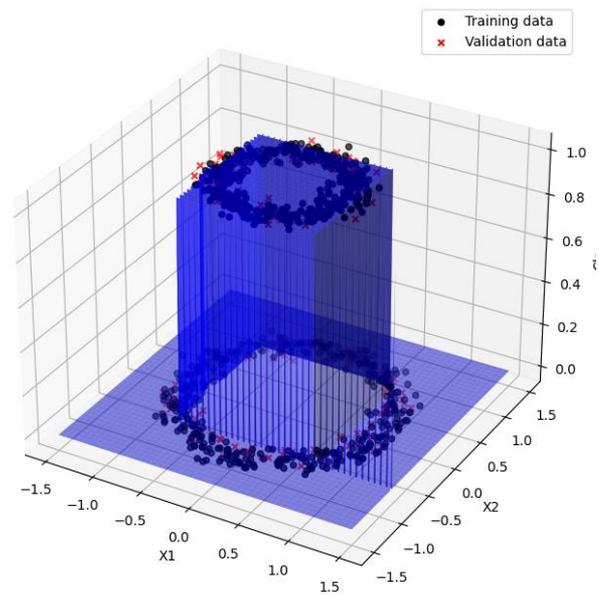




Algorithmen des Machine Learning (ML)



3D Decision Tree Classifier Decision Boundaries

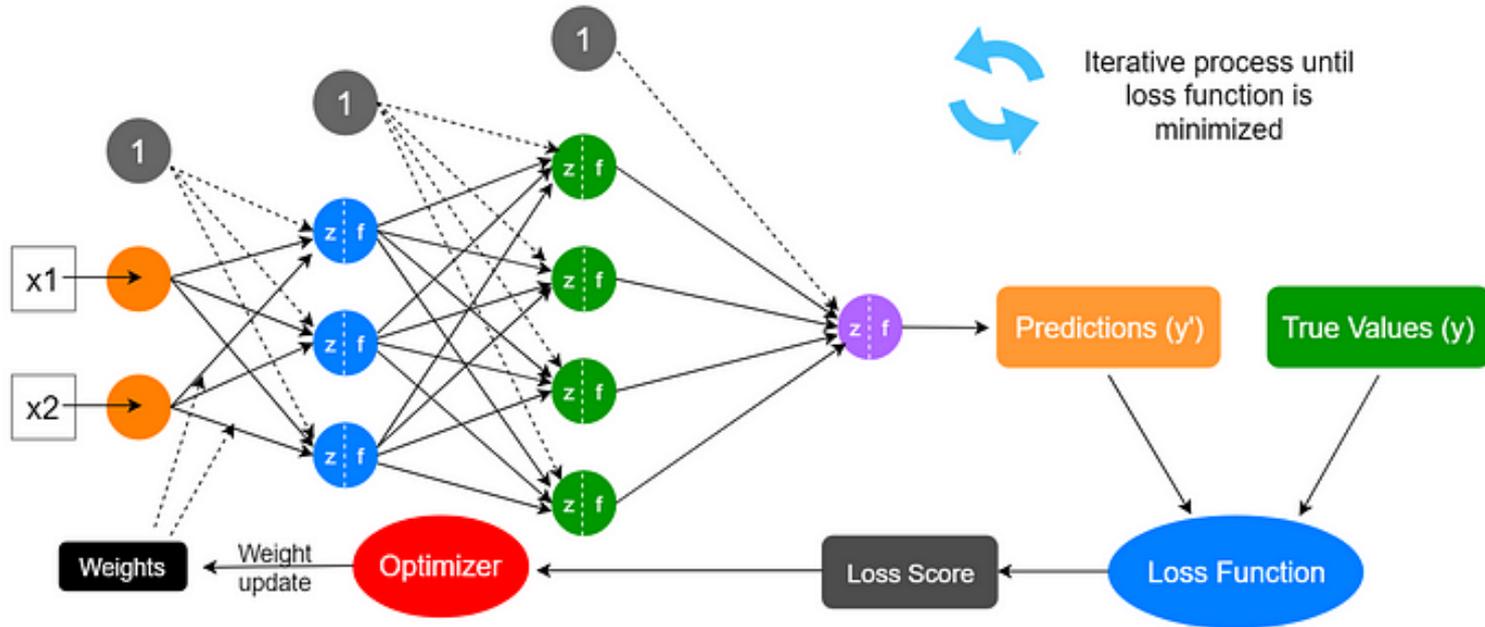


<https://www.analyticsvidhya.com/blog/2021/03/everything-you-need-to-know-about-machine-learning/>





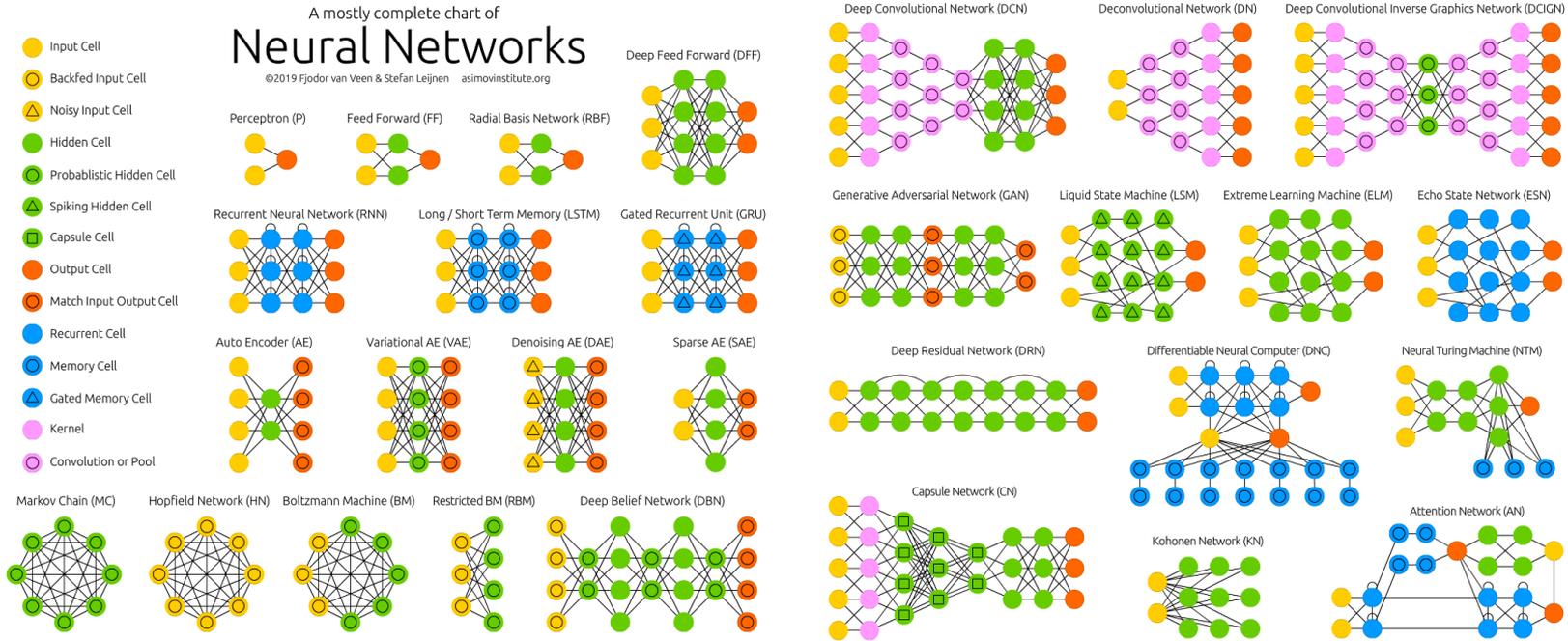
Deep Learning (DL) und Neuronale Netze



<https://medium.com/data-science-365/overview-of-a-neural-networks-learning-process-61690a502fa>



Deep Learning (DL) und Neuronale Netze



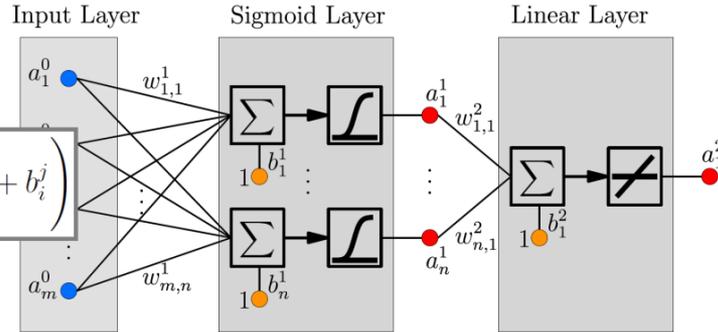
<https://www.asimovinstitute.org/neural-network-zoo/>



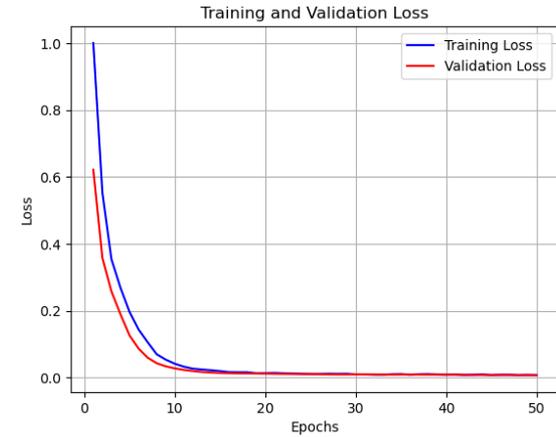
Deep Learning (DL) und Neuronale Netze

Feedforward Networks

$$a_i^j = f_i^j(x) = f \left(\sum_{k=1}^m w_{k,i}^j a_k^{j-1} + b_i^j \right)$$



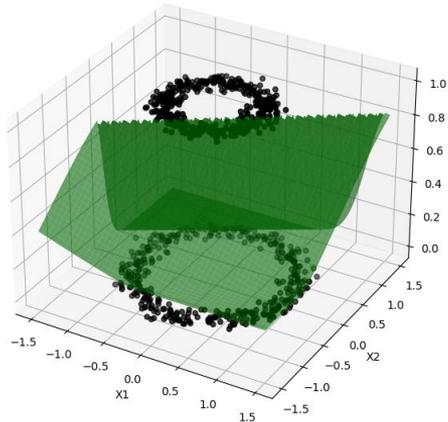
- "output" und "hidden Layer bestehen aus linearen oder nichtlinearen Neuronen
- Feedforward-Netze mit ausschließlich linearen Neuronen sind lineare Regression!
- Training durch Minimierung eines Losses (z. B. Summe der Quadratefehler) auf einem Trainingsdatensatz
- "early stopping" um eine Überanpassung zu vermeiden



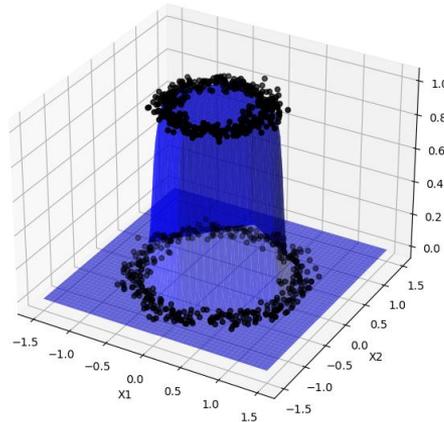


Deep Learning (DL) und Neuronale Netze

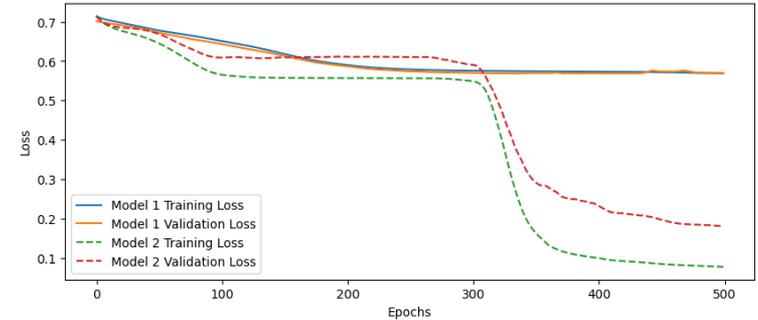
1 hidden layer, 4 neurons



2 hidden layers, 4 neurons



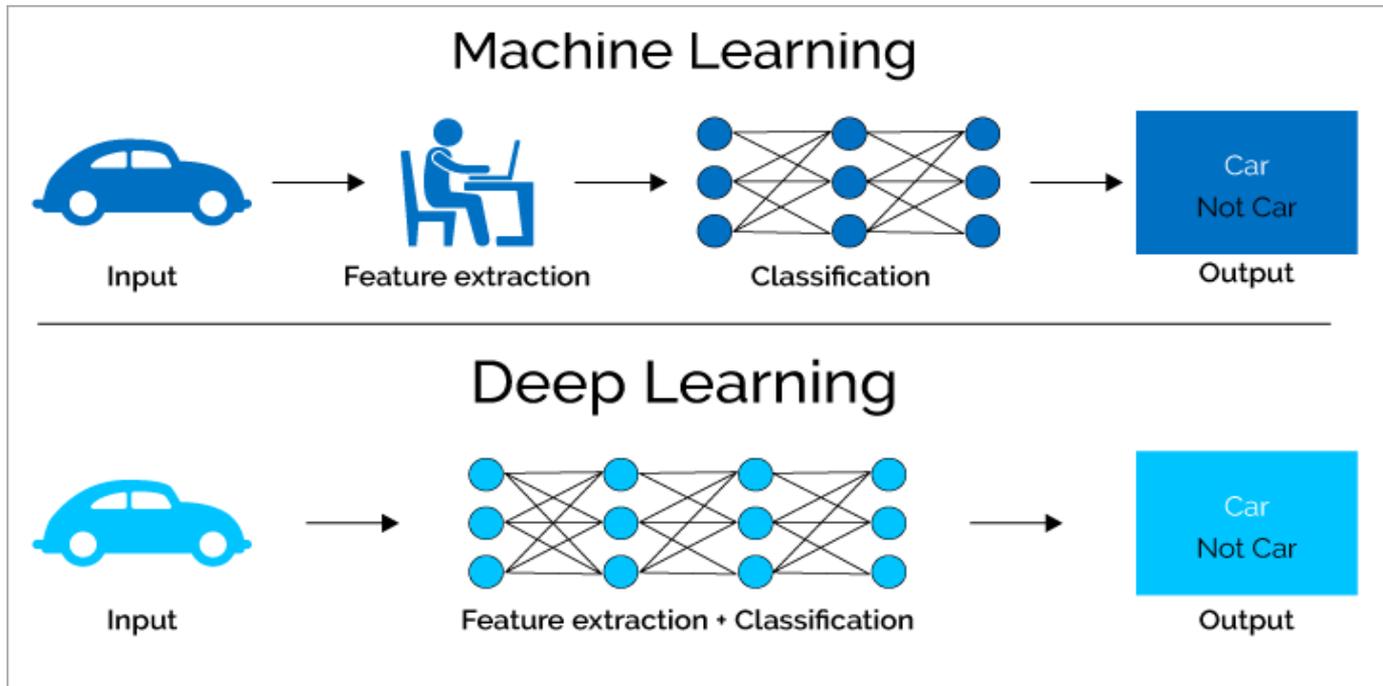
Training and Validation Loss Curves



- Neuronale Netze sind Funktionsapproximatoren
- Interaktionen können besser durch mehrere Layer abgebildet werden
- tiefe Neuronale Netze haben im Allgemeinen eine bessere Anpassungsqualität



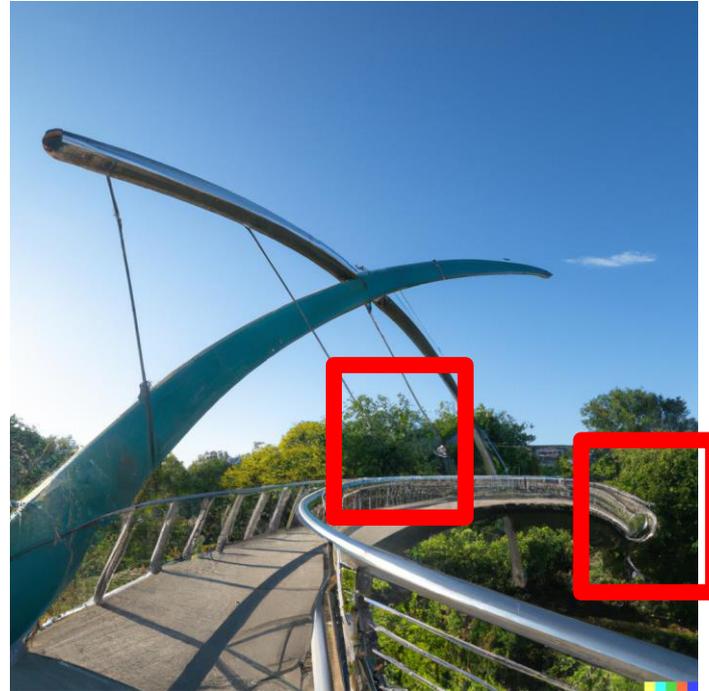
Unterschied von Machine und Deep Learning



<https://cdn.softwaretestinghelp.com/wp-content/qa/uploads/2019/04/DeepLearning.png>

Warum sollte sich das Bauwesen mit KI befassen?

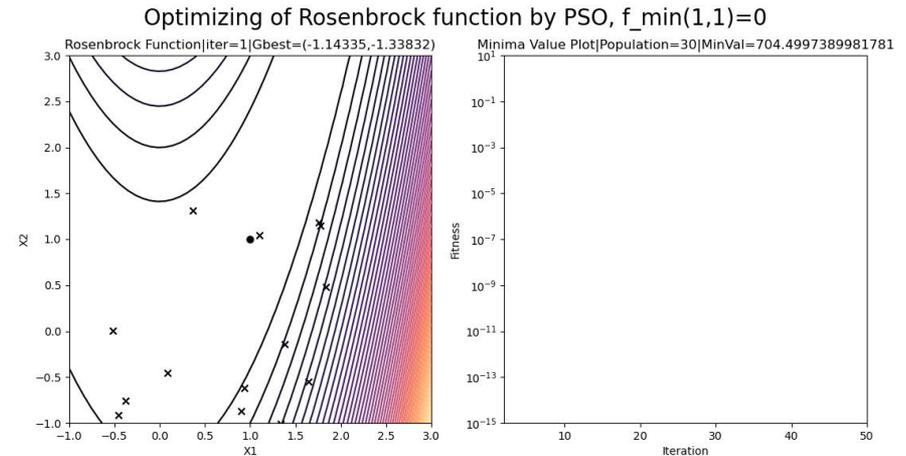
Das versteht DallE2 unter einer “*nachhaltigen Betonbrücke über einen Fluss*”





Optimierung – Hintergrund zur PSO

- eine KI-Technik zum Auffinden von Näherungslösungen für extrem schwierige numerische Maximierungs- und Minimierungsprobleme
- wurde 1995 von Kennedy und Eberhart vorgeschlagen
- basiert auf der Simulation von sozialem Verhalten
- der Algorithmus verwendet einen Schwarm von Partikeln, um seine Suche zu steuern
- jedes Teilchen hat eine Position und eine Geschwindigkeit - jedes Teilchen wird durch lokal und global beste Lösungen beeinflusst.





Optimierungs-Tool in RFEM

The screenshot displays the RFEM software interface. The main window shows a 2D truss structure with a total length of 30,000 and a height of 1,500. The structure consists of a bottom chord, a top chord, and vertical members, with diagonal bracing in the interior bays. A coordinate system is shown at the bottom left with the X-axis pointing right and the Z-axis pointing down. The left sidebar contains a 'Navigator - Data' tree with the following structure:

- RFEM
- Hauptbinder_36m_Optimierung_Rev5_Mit Leitern.rst
 - Basic Objects
 - Materials
 - Sections
 - Nodes
 - Members
 - Member Sets
 - Special Objects
 - Types for Nodes
 - Types for Members
 - Types for Special Objects
 - Imperfections
 - Load Cases & Combinations
 - Load Cases
 - Actions
 - Design Situations
 - Action Combinations
 - Load Combinations
 - Static Analysis Settings
 - Combination Wizards
 - Relationship Between Load Cases
 - Load Wizards
 - Loads
 - LC1 - Eigengewicht
 - LC2 - Nutzlast
 - Results
 - Guide Objects
 - Stress-Strain Analysis
 - Printout Reports

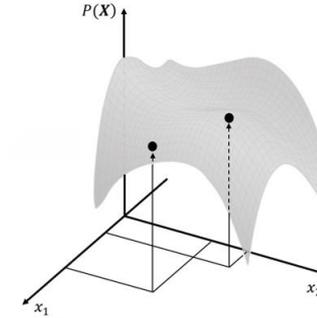
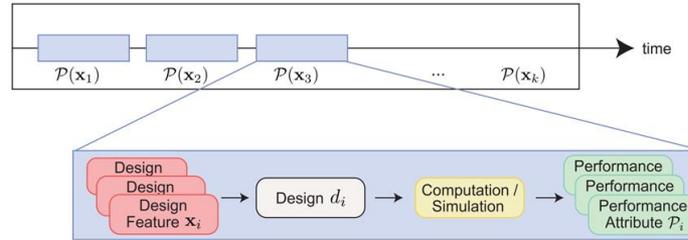
The bottom of the interface features an 'Optimization' toolbar with the following elements:

- Go To
- Edit
- Selection
- View
- Settings
- Optimization (dropdown menu)
- Order
- OPTIM** (button)
- Optimize (button)
- Input field

At the bottom left, the status bar shows '1 of 1' and 'Optimized Values'.

Optimierungstool – künftige Weiterentwicklung

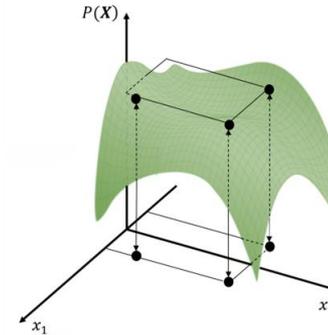
State-of-the-art



Forward Design



Design
Meta-Models



Inverse Design



ChatBot-Hilfe



The screenshot shows the Duibal RFEM 6.03.0008 software interface. The main window displays a 3D structural model of a building frame. On the right, a chatbot window titled "RFEM 6 Help ChatBot" is open, showing a conversation:

Hi

Hello there! How may I assist you today?

How do I exclude specific load combinations (COs) in the design add-on?

As an AI language model, I can suggest the following methods:

- In the Load Combinations tab, select the load combinations (COs) to be excluded and then uncheck the "To Solve" option.
- Alternatively, the COs or RCs (result combinations) can be excluded in the table of the design add-on.
- Also another possible way is...

Stop generating...

Ask me anything...

At the bottom of the screenshot, a table is visible with the following columns: Material No., Material Name, Material Type, Material Model, Modulus of Elast. E [N/mm²], Shear Modulus G [N/mm²], Poisson's Ratio ν [-], Specific Weight γ [N/m³], Mass Density ρ [kg/m³], Coeff. of Th. Exp. α [1/°C], Option, and Comment.

Material No.	Material Name	Material Type	Material Model	Modulus of Elast. E [N/mm ²]	Shear Modulus G [N/mm ²]	Poisson's Ratio ν [-]	Specific Weight γ [N/m ³]	Mass Density ρ [kg/m ³]	Coeff. of Th. Exp. α [1/°C]	Option	Comment
1	Steel		Sturzbau / Linear-Elast.	210000.0	80782.0	0.300	78.50	7850.00	1.200012		
2											
3											
4											
5											
6											
7											
8											
9											
10											



ChatBot-Hilfe

- ChatBot basierend auf generativer KI
- trainiert mit den Daten der FAQ, Knowledge Base und der Handbücher
- wird auf der Homepage aber auch in den Programmen zum Einsatz kommen



Dlubal GPT

Dlubal's RFEM 6 expert

By Dlubal Software GmbH

How do I use the RFEM6 interface?

Where can I find more info about RFEM5?

Can you explain a feature in RSTAB9?

Help with a specific problem in RFEM6?

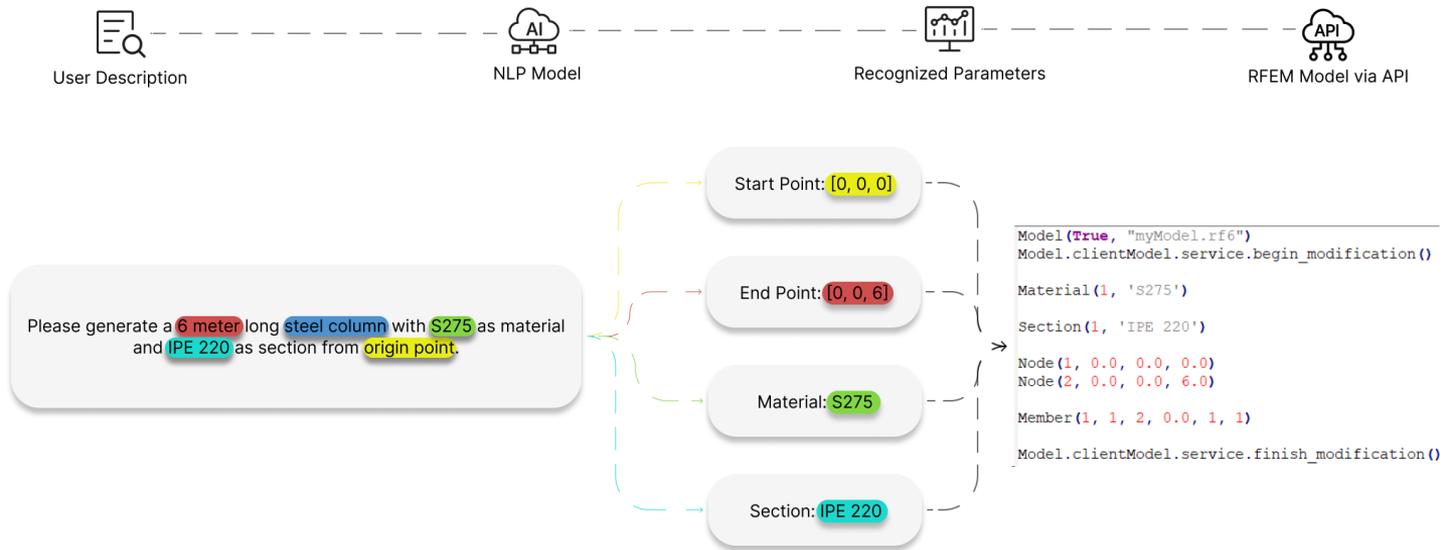
 Message Dlubal GPT...

I





Entity Recognition für das Text2Model Interface



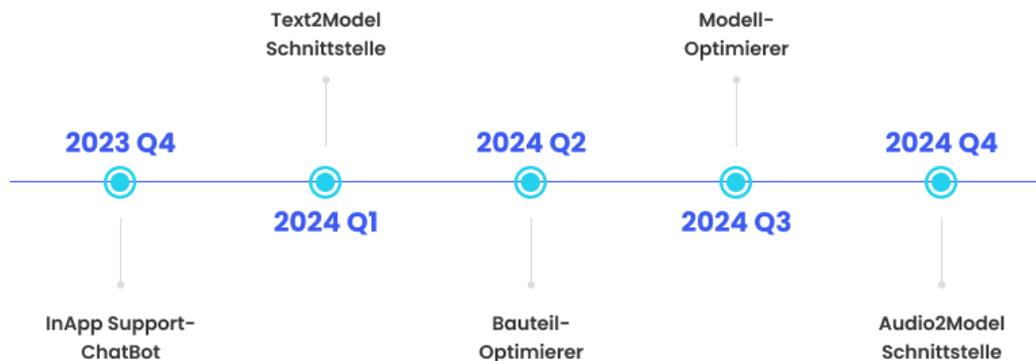


Entity Recognition für das Text2Model Interface

The image shows two side-by-side windows. The left window is a web browser displaying the 'Dlubal Text2Model Interface - Member Model'. It features a dark theme with a 'Deploy' button in the top right. Below the title, there is a 'Description:' label, a text input field containing the placeholder text 'Describe the model you want me to create!', and a 'Create' button below it. The right window is the RFEM software interface, version 6.04.2009. It has a standard menu bar (File, View, Options, Help) and a toolbar. A 'Navigator' pane on the left shows a tree view with 'RFEM' selected. The main workspace is currently empty. At the bottom, there is a 'Tables' pane with a sub-menu (Go To, Edit, Selection, View, Settings) and a 'Basic Objects' section.



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COO of Dlubal Software GmbH



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Kostenlose Online-Dienste

Youtube-Kanal - Webinare, Videos

Sehen Sie sich die Videos und Webinare zur Statiksoftware von Dlubal an.



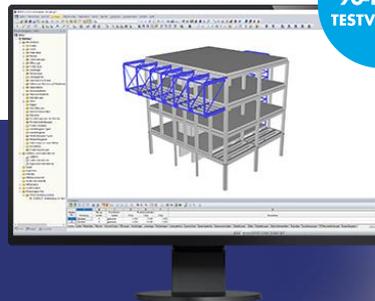
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Erstellen Sie Ihr individuelles Softwarepaket und sehen Sie alle Preise online!



Testversionen

Sie lernen am besten, wie Sie mit unseren Programmen umgehen, indem Sie sie einfach selbst testen. Laden Sie sich die 90-Tage-Testversion unserer Statikprogramme herunter.



90-TAGE-
TESTVERSION



Kostenloser Support per E-Mail und Live-Chat



Hier finden Sie weitere Informationen zu Dlubal Software



Besuchen Sie unsere
Webseite

www.dlubal.com

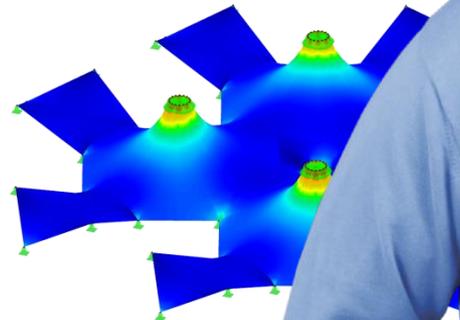
- Videos und aufgezeichnete Webinare
- Newsletter
- Veranstaltungen und Messen/Seminare
- Knowledge Base-Artikel



Sehen Sie den
Einsatz von
Dlubal Software
in einem
Webinar



Kostenlose
Testversion
herunterladen



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