SME AI-Transformation in the Era of Industry 4.0

Building a Knowledge-base for a Precision Manufacturer to store Knowhow and connect the Dots of Designing, Manufacturing & Testing Products on Platograph+Q2 System

PLATOGRAPH

Quantinar + Quantlet

Brent Cheng

CEO of IDP Co., Ltd.

Vice President, Taiwan Chamber of Industry & Commerce

The 3rd Yushan Conference & The 17th NYCU International Finance Conference
12/08/2023

*** IDP representing Taiwanese precision manufacturers to participate in MSV International Engineering Fair, Brno, Czech Republic, 2023**

AIoT/ESG : Smart City / Smart Building & Home / Smart Manufacturing

Some notes before we begin the presentation:

(1) Many thanks to Prof Wolfgang Karl Härdle and NYCU for inviting me to share our experiences as a precision manufacturer to take on the challenges of the AI transformation amid the current wave of industrial revolution.

(2) This session was originally intended for Dr Jenher Jeng, the inventor of Platograph system and one of the sponsors for this conference, to present "Tokenomics of Personalized Knowledge Base". Unfortunately, he has lost his capability for vocal communication after his trip to Europe for attending a machine learning conference in Prague and the engineering fair in Brno. We hope he can recover from his illness soon to share his ideas and innovations on this topic.

(3) Although my talk's tile seems distant from Dr Jeng's intended talk's title, as a matter of fact, they are quite deeply related if you think a bit more about how the economy works from employees to enterprises to networks of supply chains to end-products to consumers. you'll find the idea of "digital twin" very interesting, and you might agree with me about the vision that the perception of "digital twin" and the value of intangible asset on the blockchain must dominate the future of digital economy – please see the BBC article: Why you may have a thinking digital twin within a decade. I believe that, combining Platograph and the Q2 system, we can train more and more talents to cooperate with AIs so that our precision manufacturing knowhow can be copied from our human brains into machines token by token on blockchain – that is, weaving knowledge to assemble the digital brain edge by edge in advanced graph techniques based on the architecture of intelligence (AoI), according to Dr Jeng's thoughts about AGI.

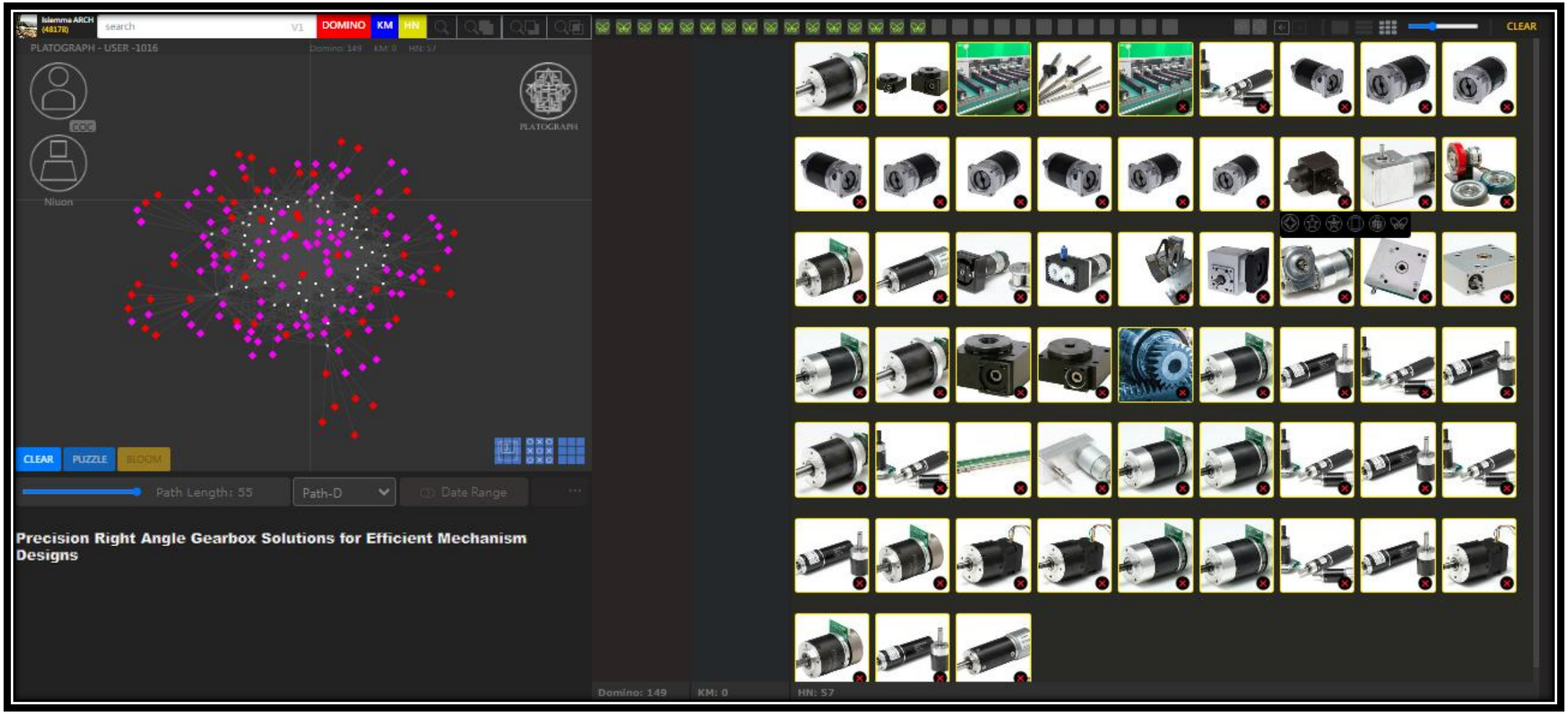
To fill in the formidable "gap" of transforming from a conventional manufacturer to a smart factory, here are the three steps for us to build our company's "digital brain" (AoI knowledge-base) on Platograph+Q2:

I. One **G**raph – we build a graph to link our products. After all, a company is best represented by all its products in a big picture.

II. One **A**rray – we train our employees and interns to learn from Coursera (fundamentally) and Quantinar (advancedly) and assemble what they co-learned from problem-solving skills to industrial/economic development trends, and even entrepreneurship mindsets in **MMX** formation of knowledge modules to be stored and connected on Platograph, later also demonstrated by my son Bruce for IDP's Moonshot project.

III.One **P**ath – we try to solve problems (designing or refining) in the SOP of **ARCH** 20 Steps (Adaptivity, Robustness, Consistency & Humanity) based on the Architecture of Intelligence (**AoI**) to connect the dots of idea, knowledge, experience, creation and wisdom. After all, ESG is not a buzzword to make money, but a responsibility and passion to innovate for making the world better against the threats of climate change. Hope, in the future, we'll have a tale to tell like Linde's story from ice-making for brewery to thermodynamics to refrigerator to helium liquefication for inspiring the discovery of superconductivity by Onnes.

IDP’s Product Graph in One Graph



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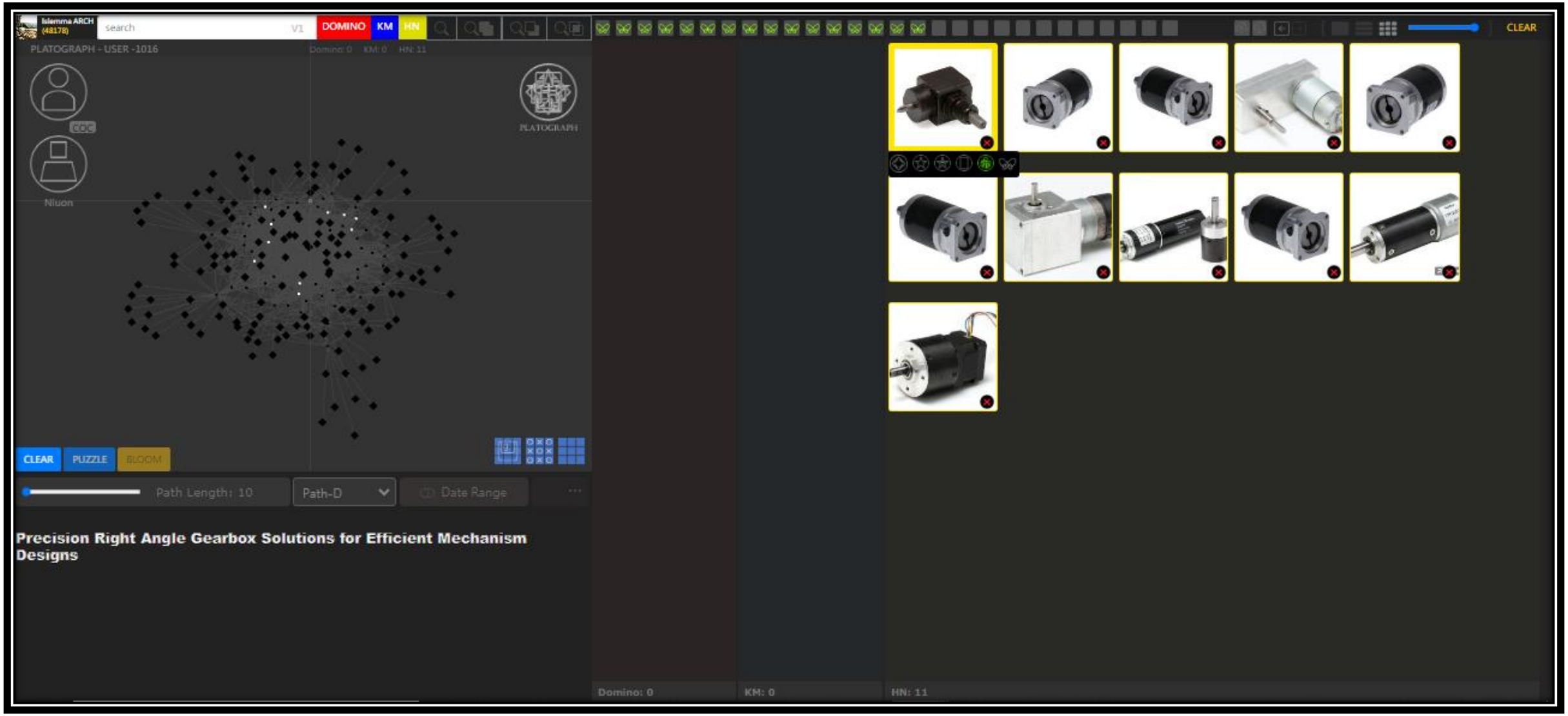
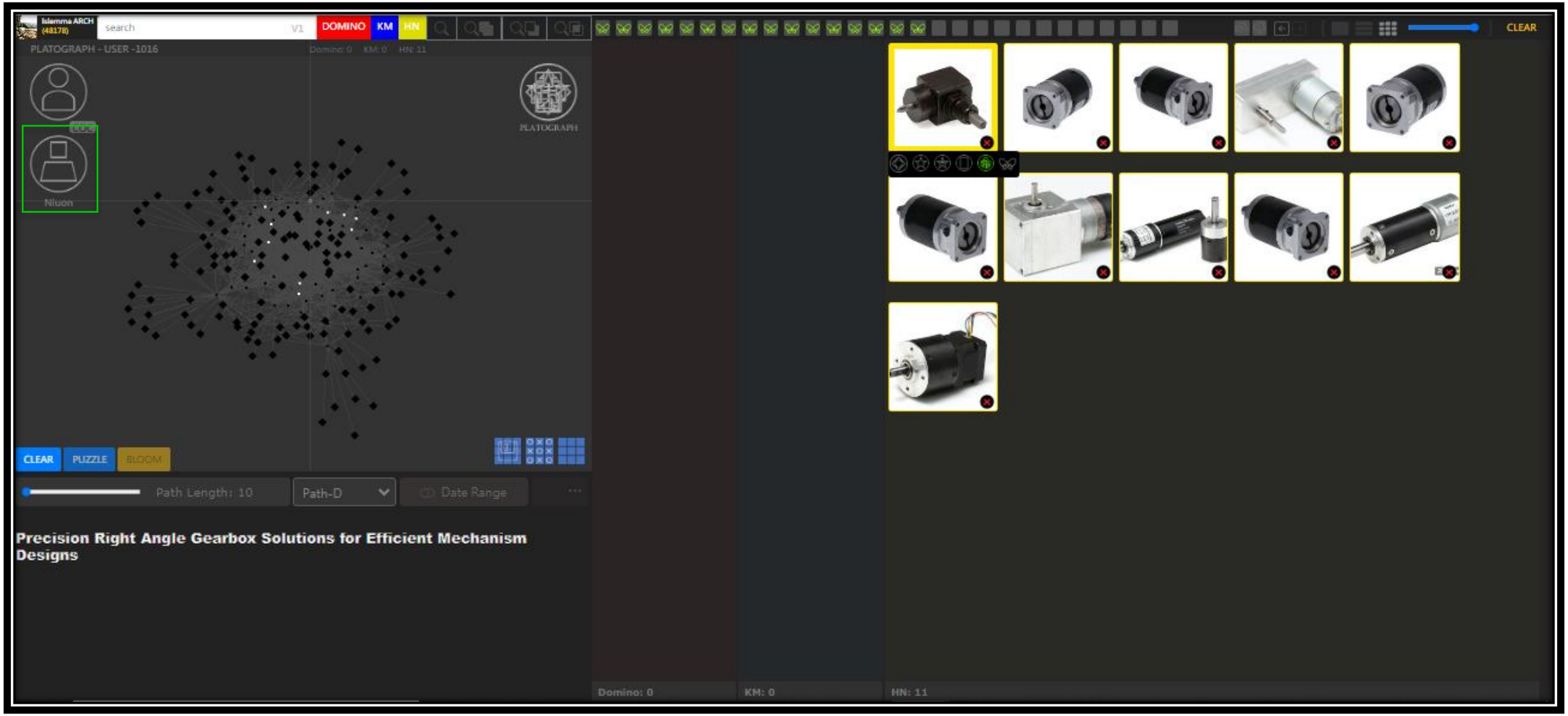
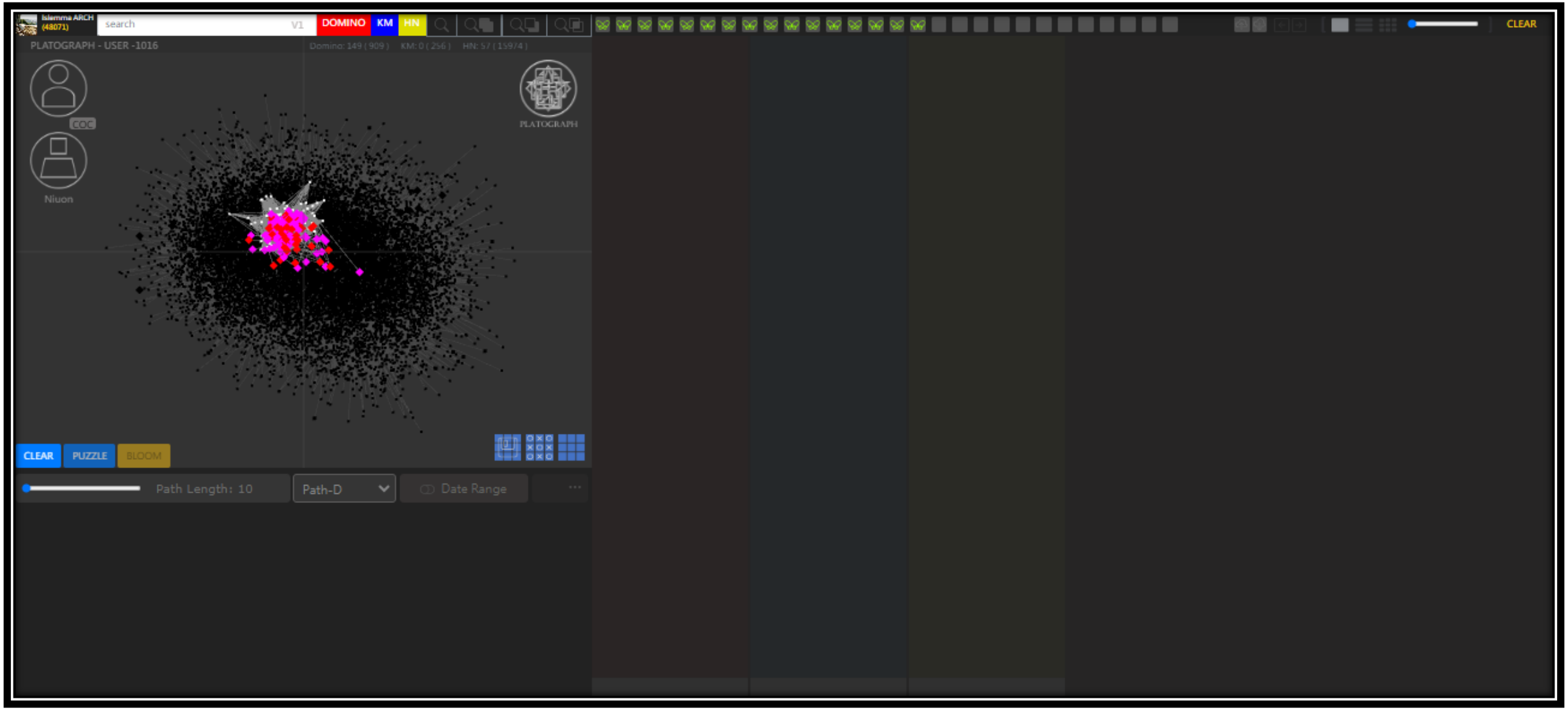
The AI-bot Pathon's Assembly of Product Portfolio



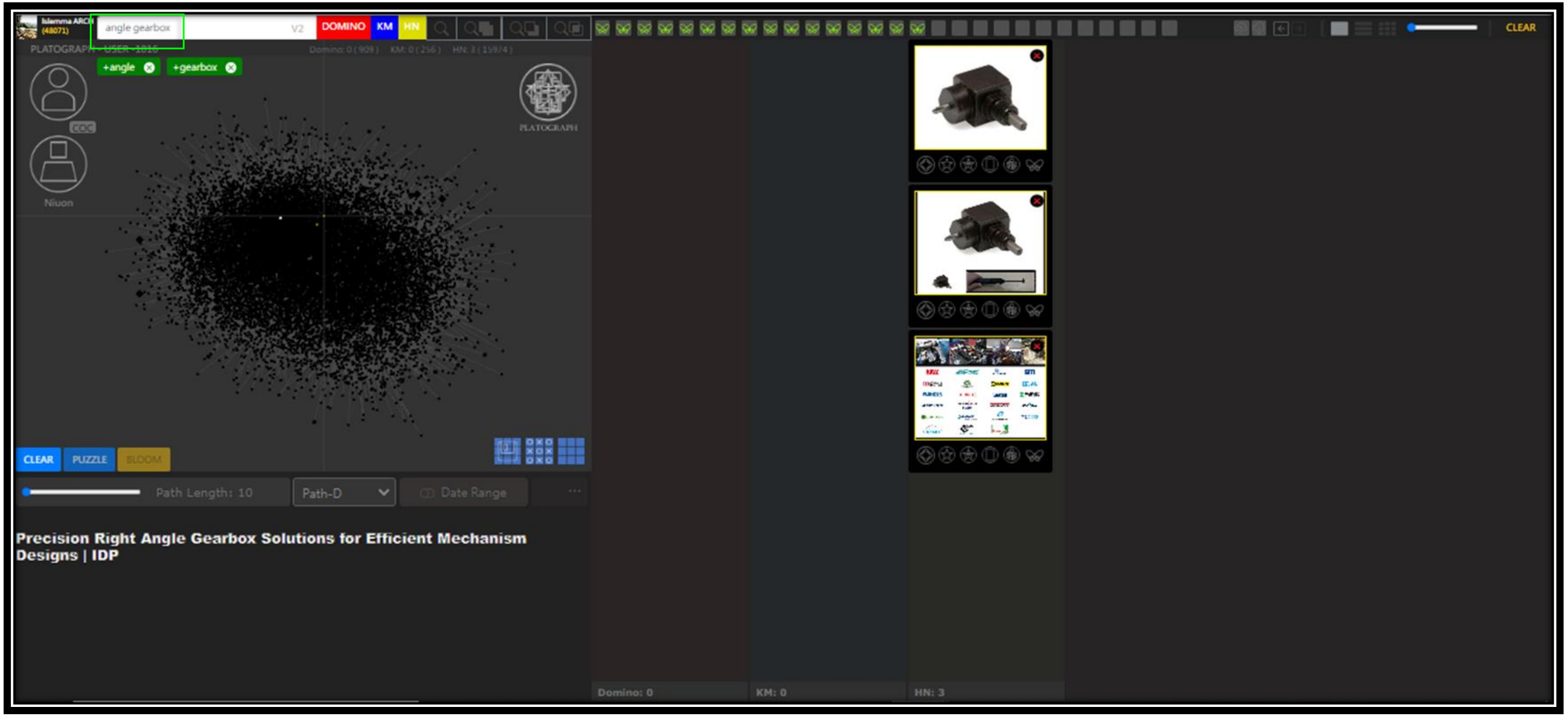
Linking to the AI-Bot Niuon (a Polymath Bot)



Connecting the Product Graph to the Nuion's "Digital Brain"

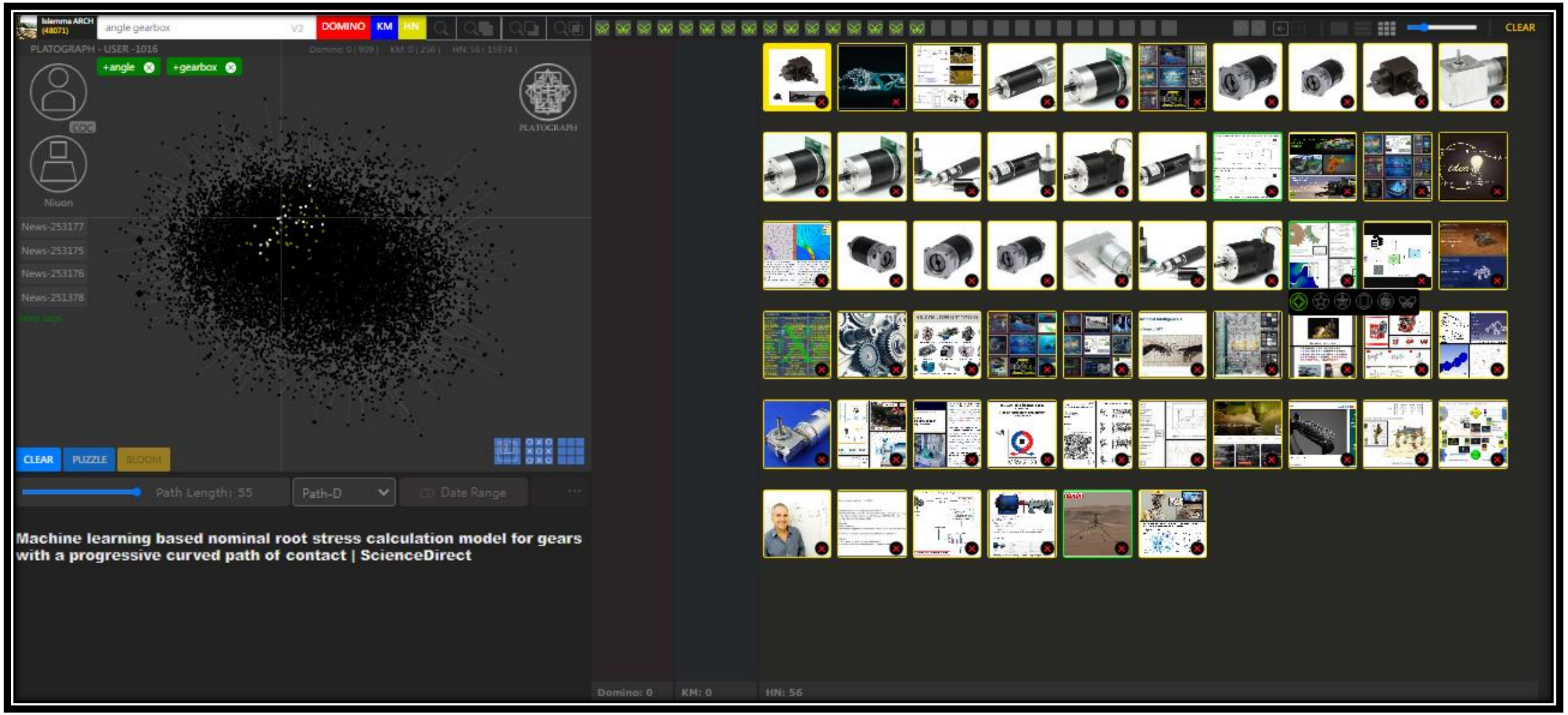


Finding a Product of Interest

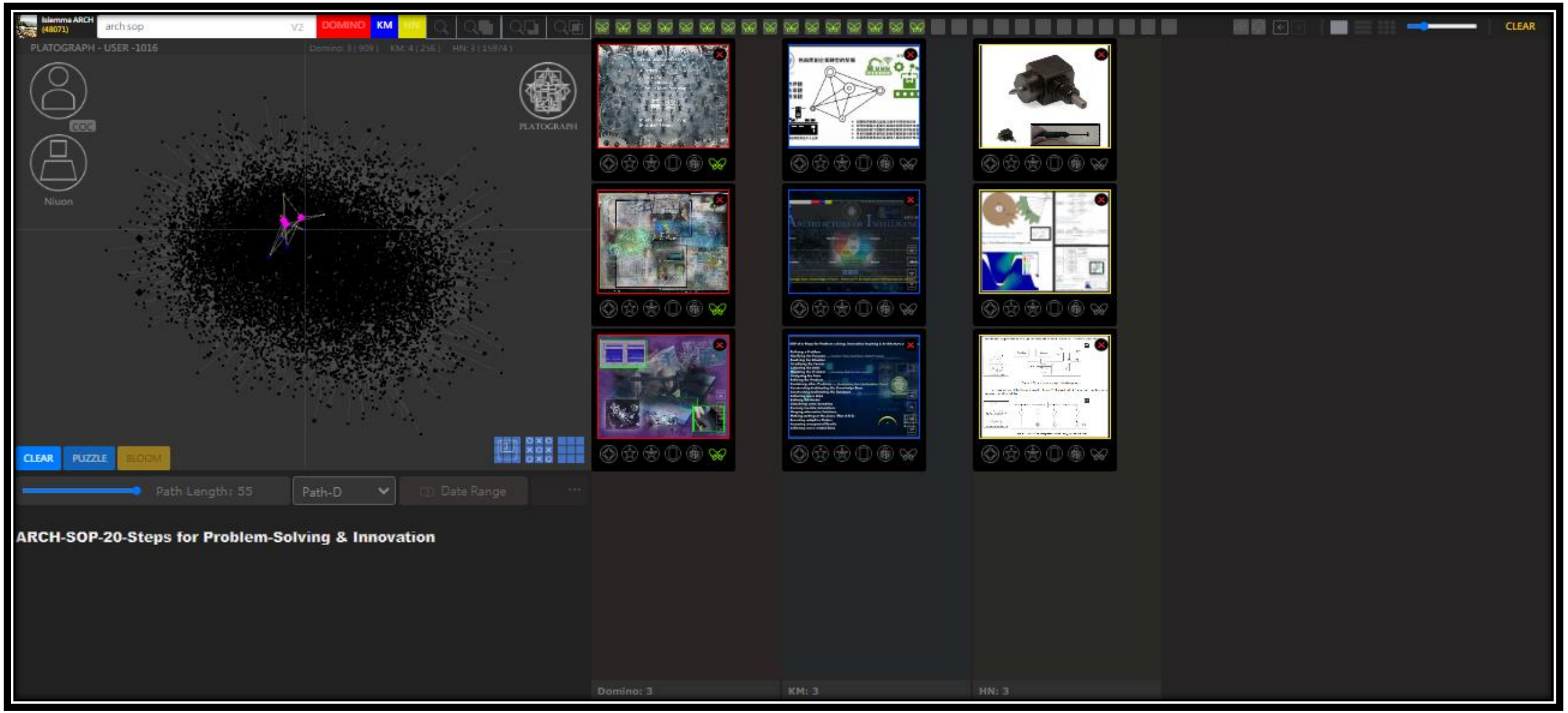


One of IDP's Proudest Products about the Size of a Fingertip

Niuon & Pathon recommending Related Knowledge



Human assembling MMX* from AI's Knowledge Puzzle



* MMX : MindMatrix – Knowledge Module

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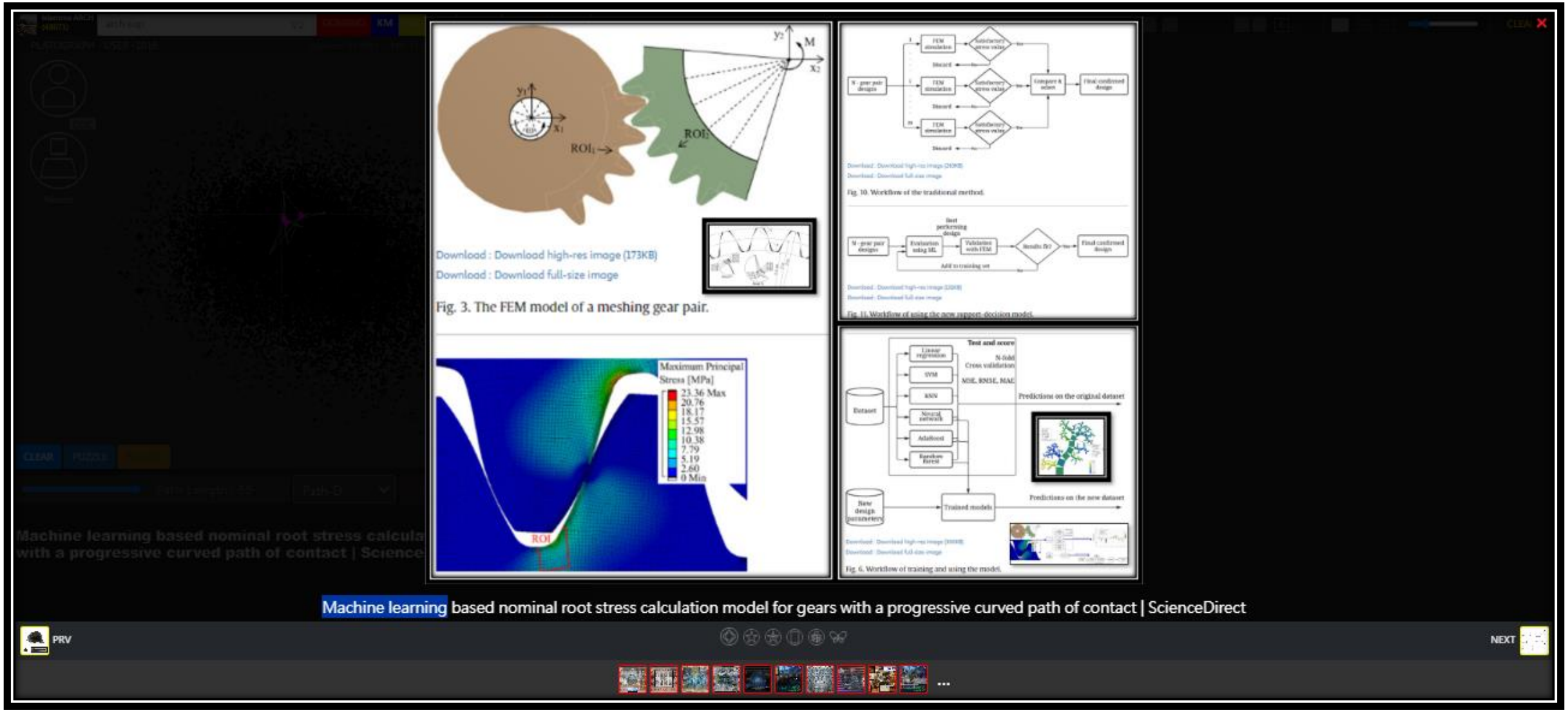
Machine Learning for Designing Gears in FEM Simulation



Machine Learning for Monitoring Gearbox in Fault Diagnosis

Note that the adaptive weights were updated via NLMS algorithm (Section 2.3) with every sample obtained.

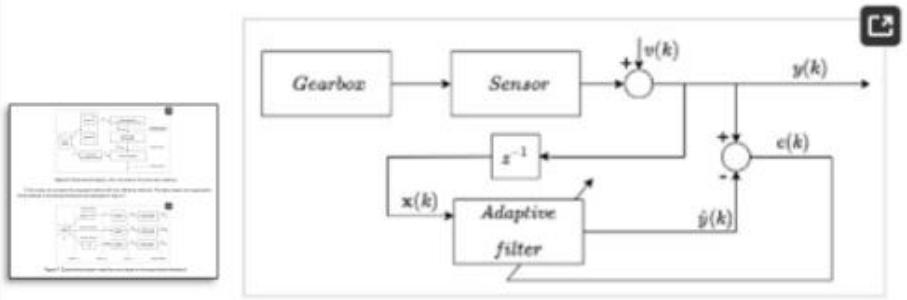


Figure 1. Block schema of adaptive filtration process.

The block schema of the filter is depicted in Figure 2. The block with z^{-1} represents unit time delay consider Z-transform notation).

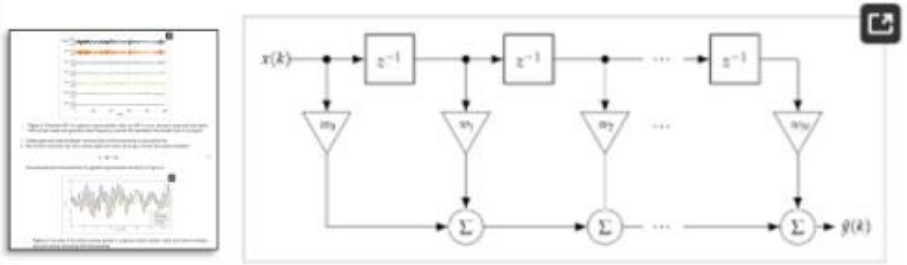


Figure 2. Block schema representation of a digital adaptive filter.

Entropy: A Machine Learning Approach for Gearbox System Fault Diagnosis

PRV

NEXT

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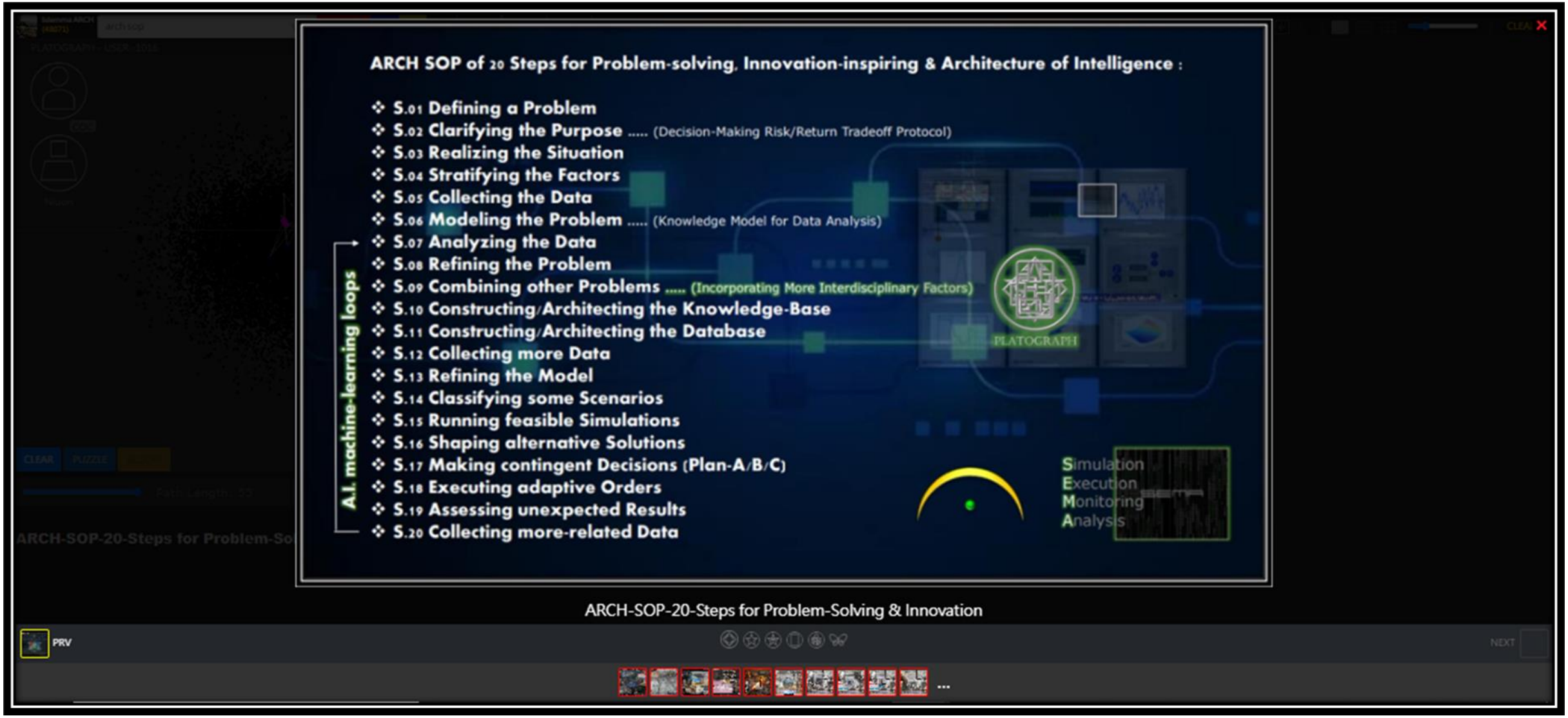
Architecture of Intelligence (AoI) to build Digital Brain

ARCH SOP of Problem-solving based on AoI



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Needs to learn Mechanical Engineering & Statistical Modeling

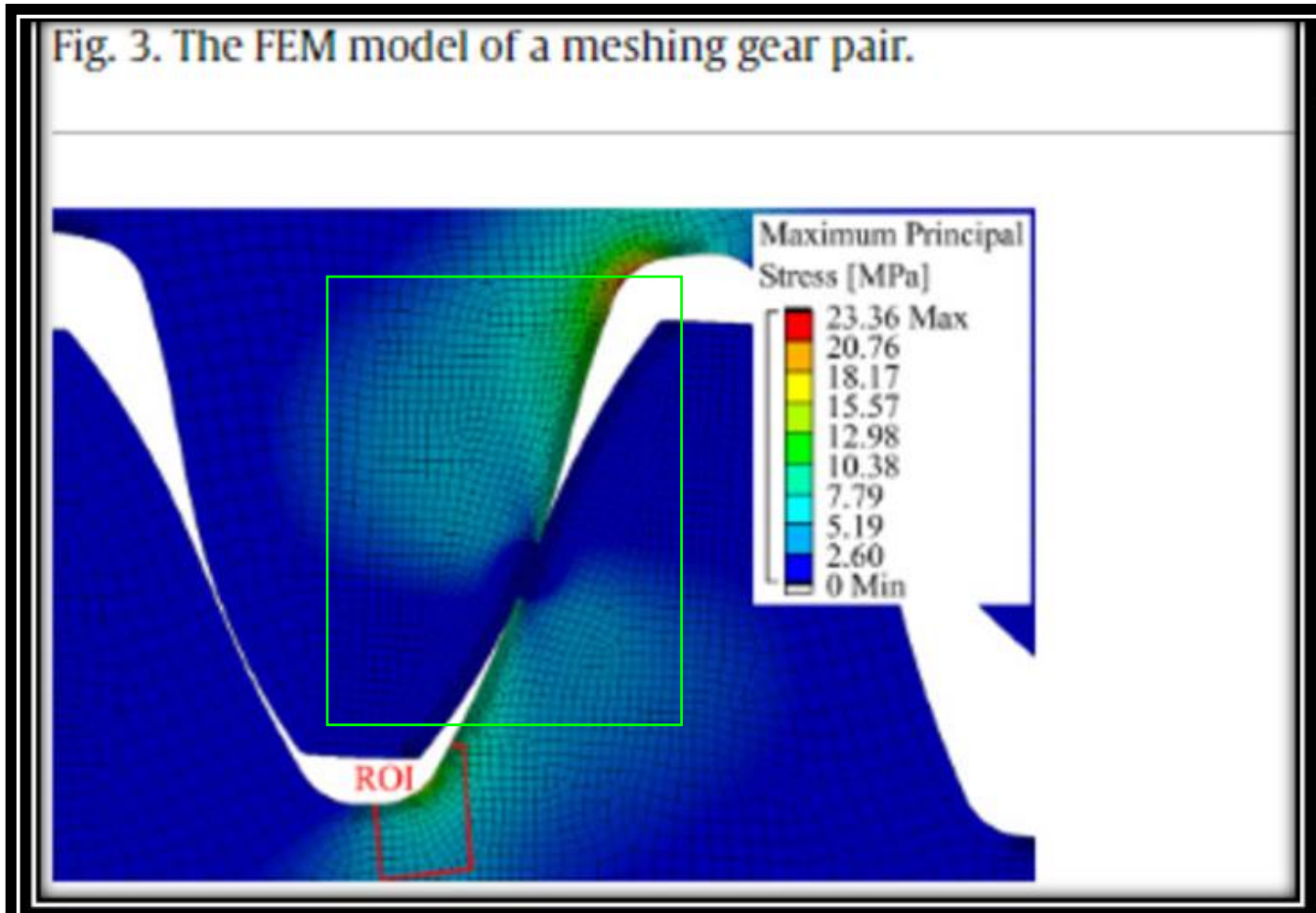


Fig. 3. The FEM model of a meshing gear pair.

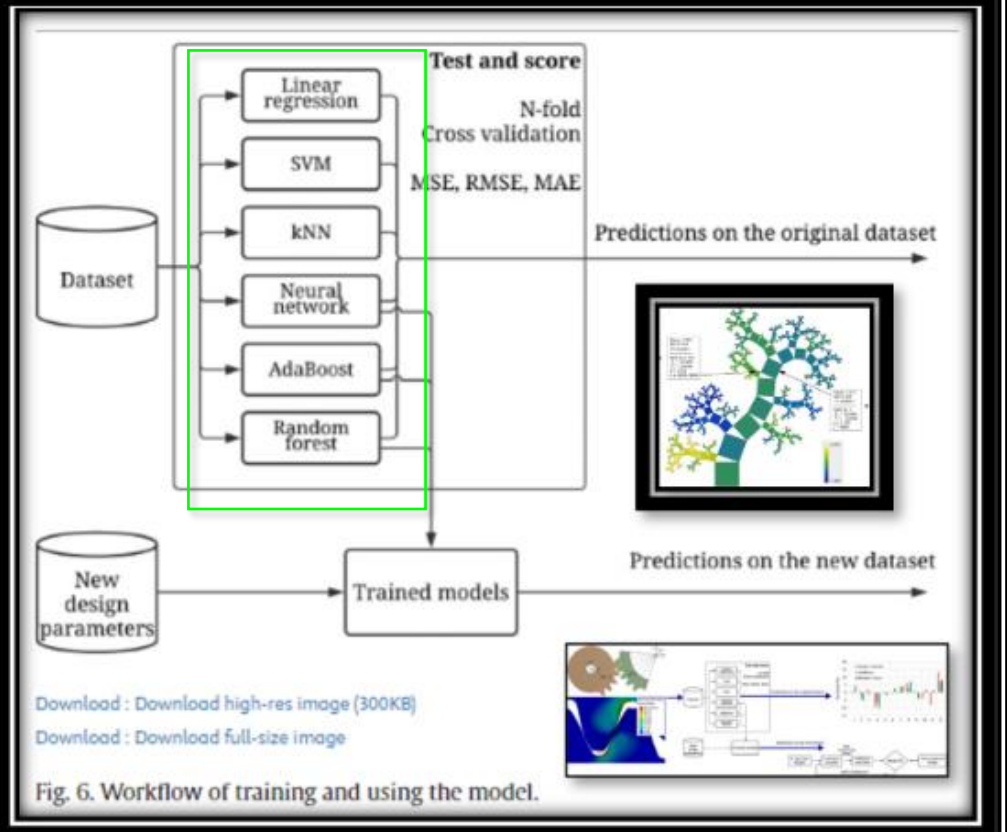


Fig. 11. Workflow of using the new support-decision model.

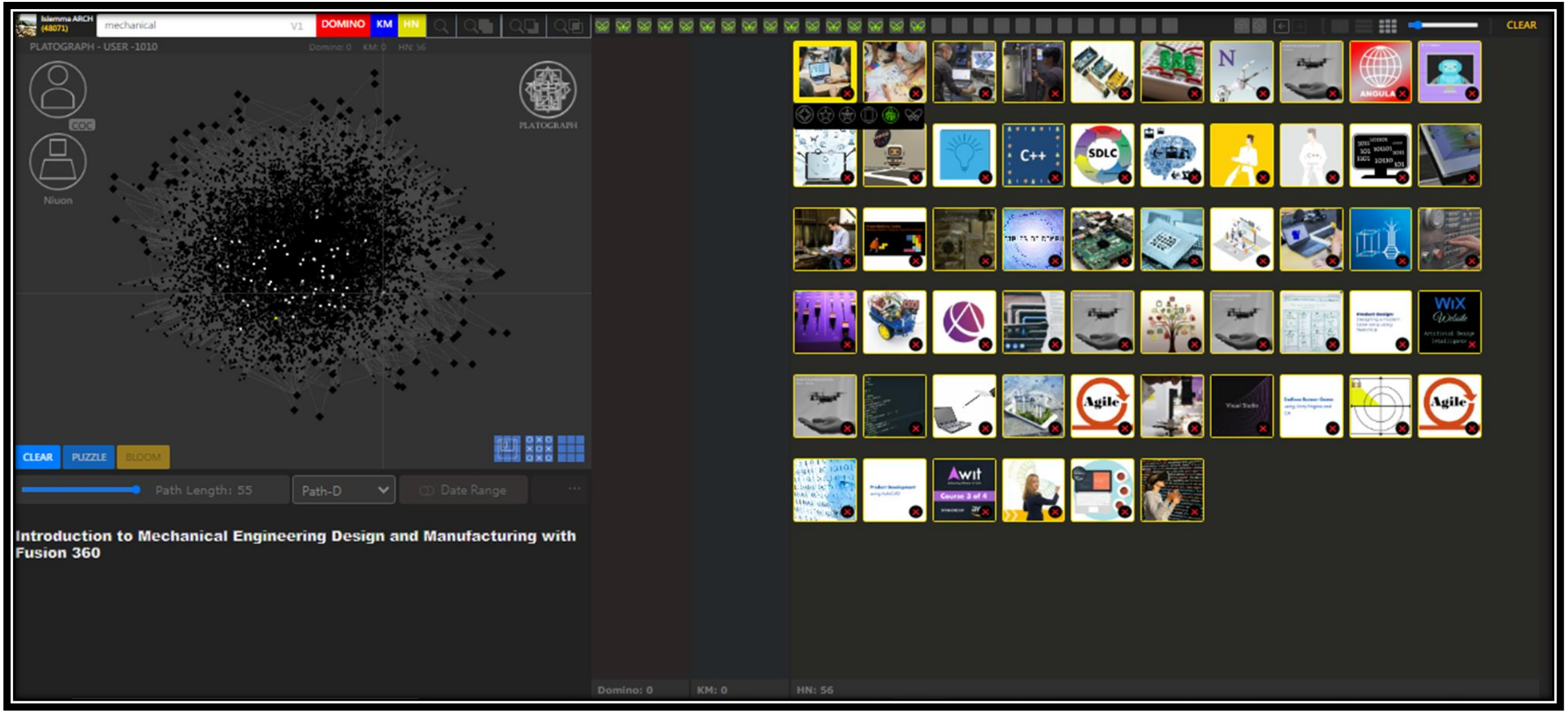
Fig. 6. Workflow of training and using the model.

ng based nominal root stress calculation model for gears with a progressive curved path of contact |

All Courses of Coursera in One-Graph on Platograph

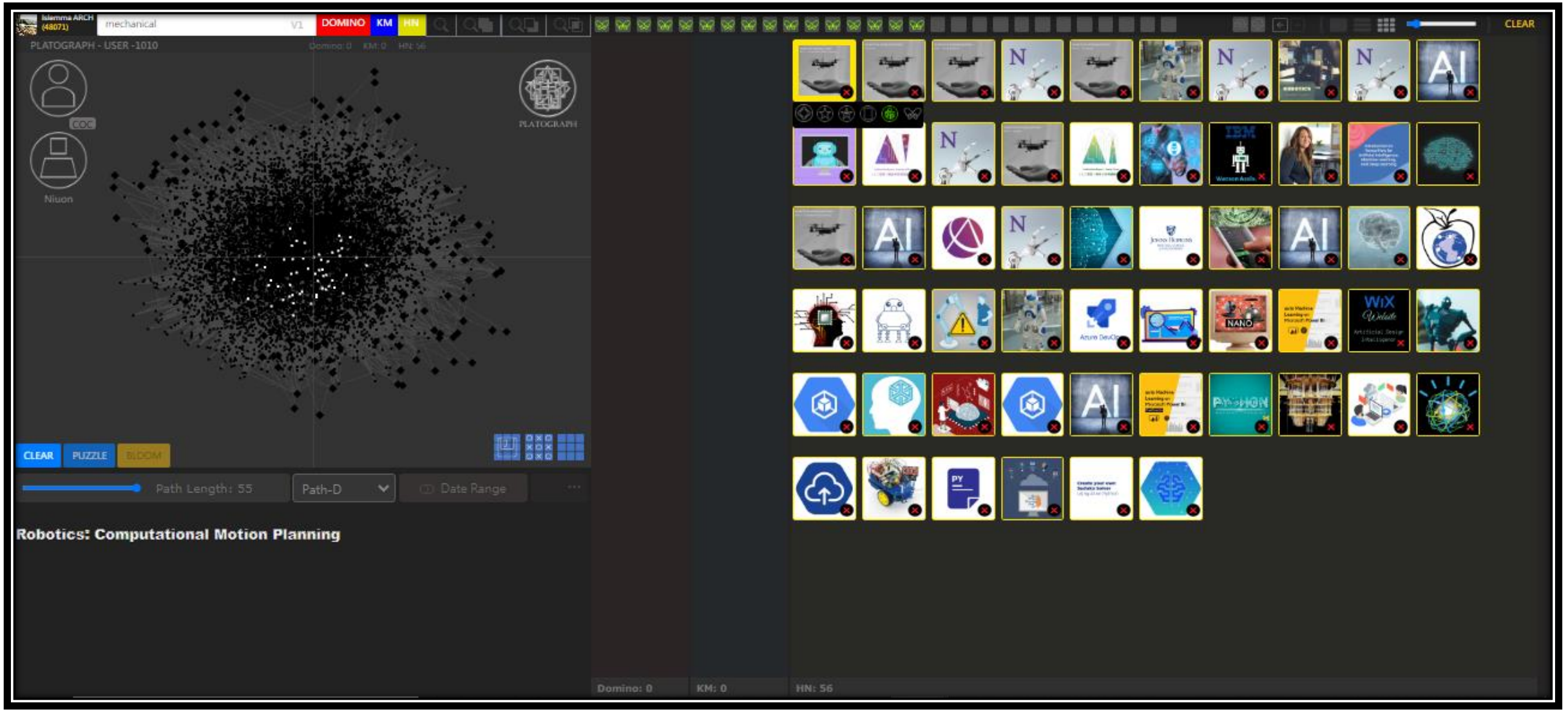
Only Six Courses containing Keyword “Mechanical”

But Pathon can help Finding More Related Courses

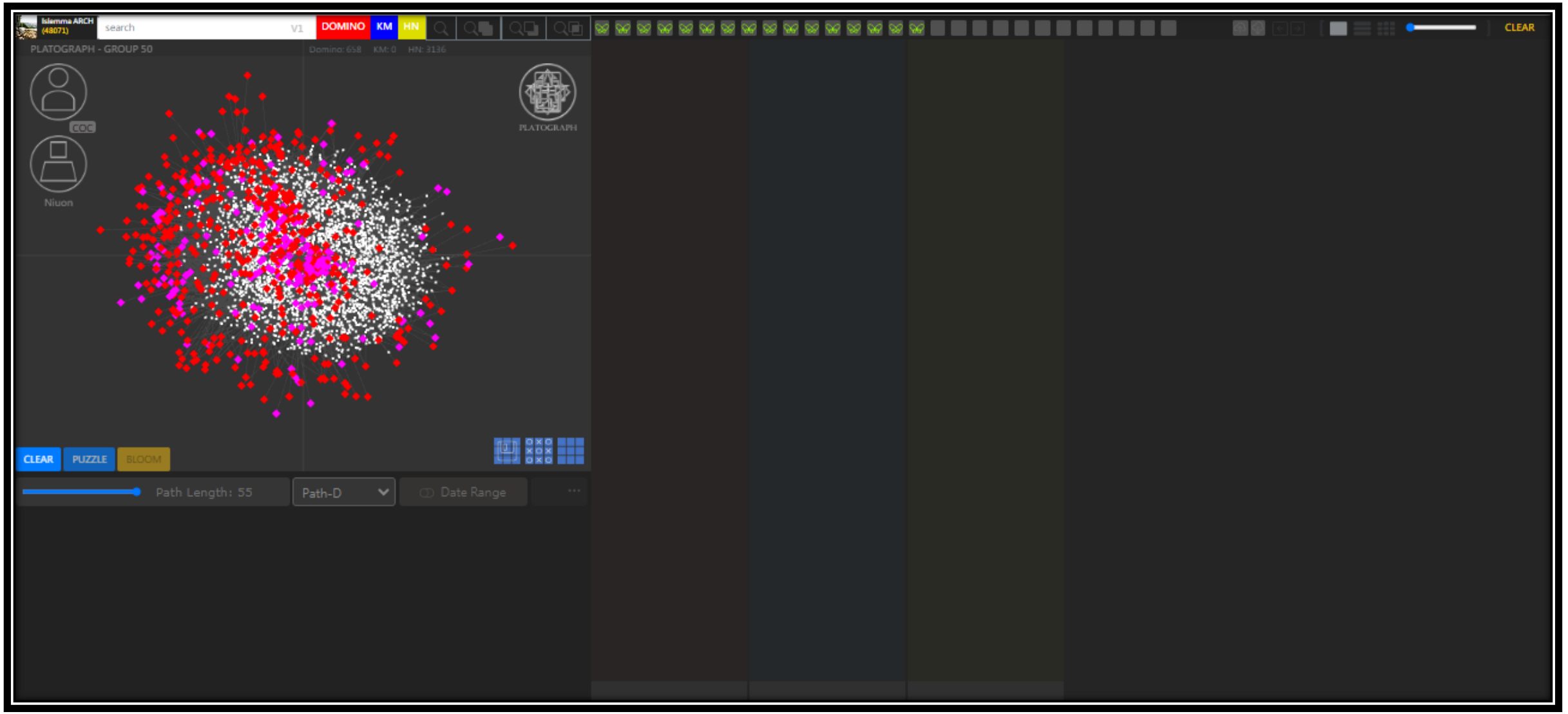


Bingo! Course to learn Applications of IDP's Tiny Angle Gearbox

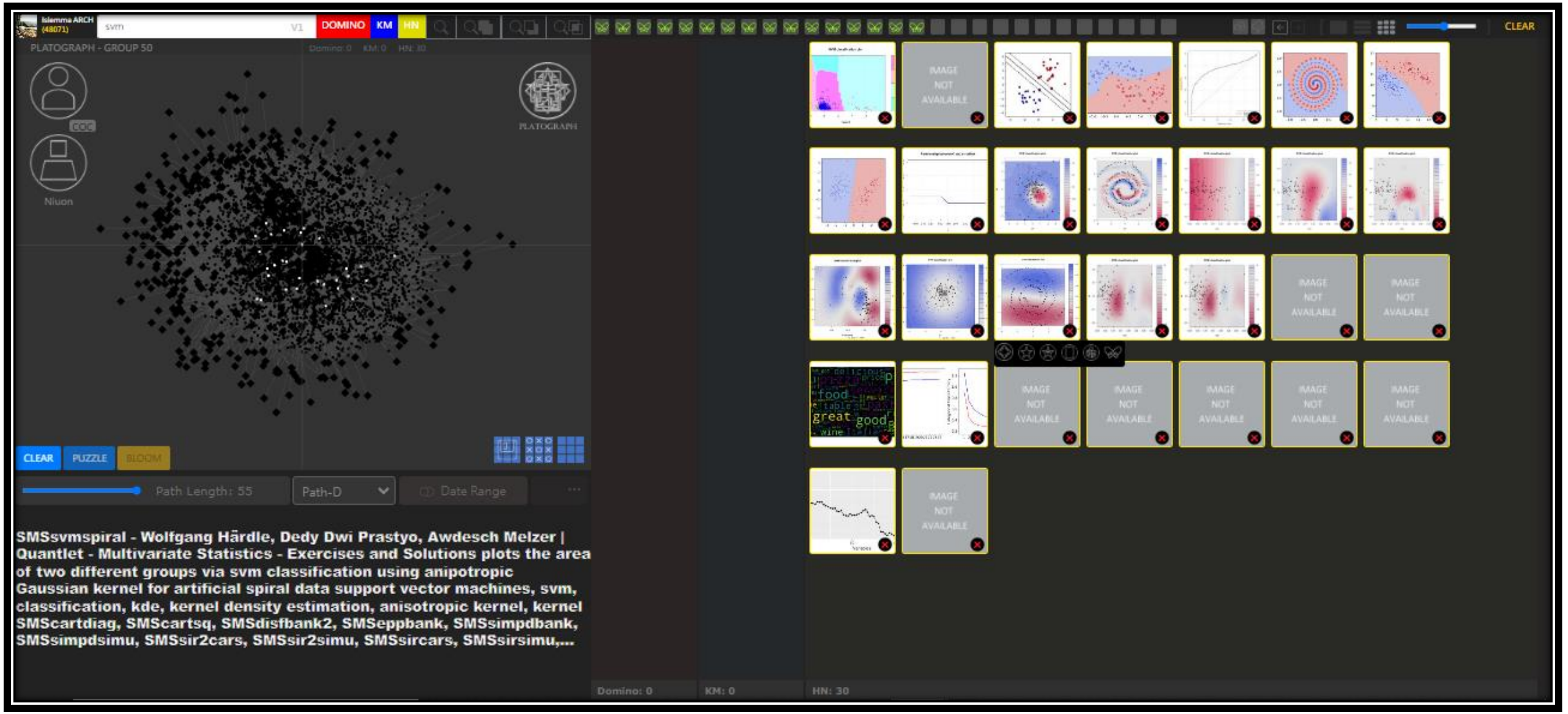
Pathon finding Even More Related Courses in Node-Extension



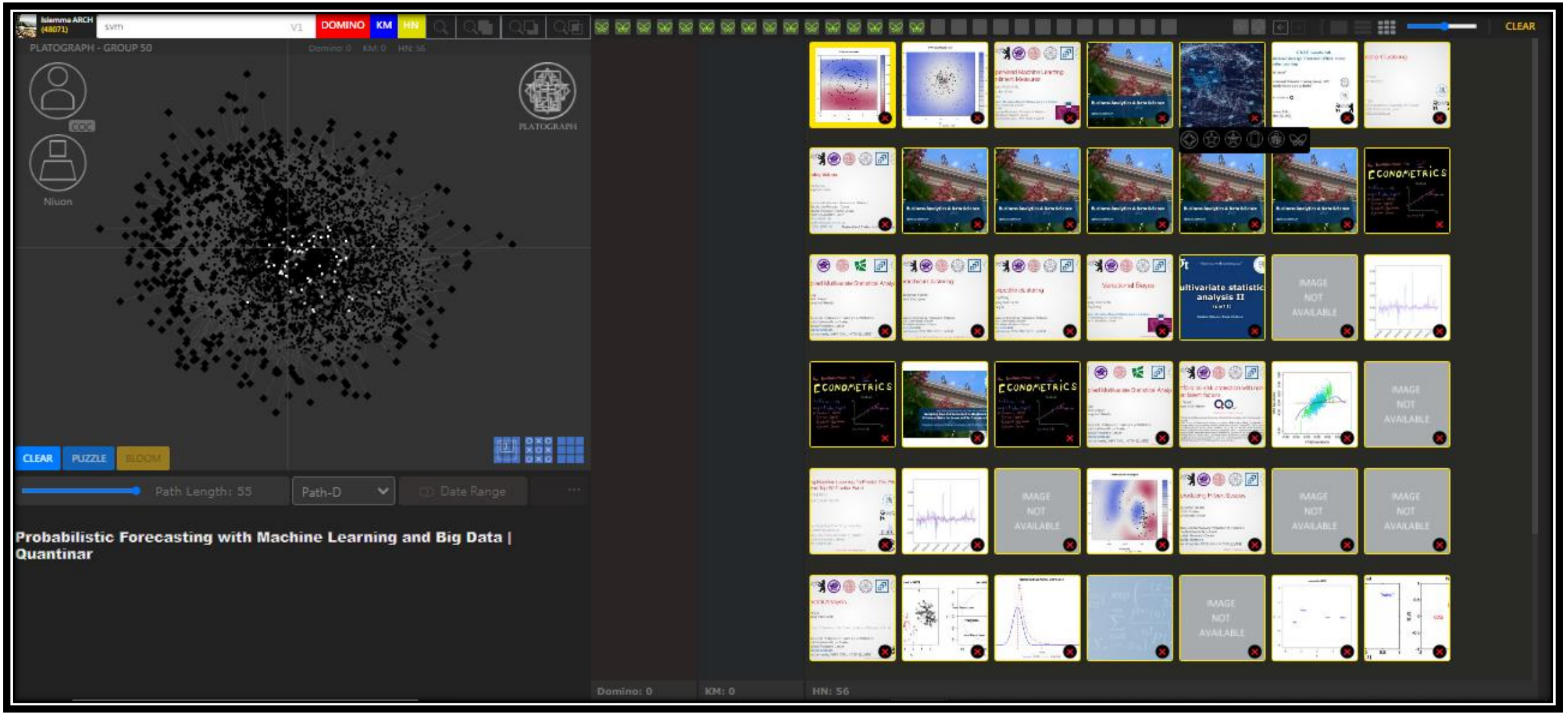
All Q2 Courselets & Quantlets in One-Graph on Platograph



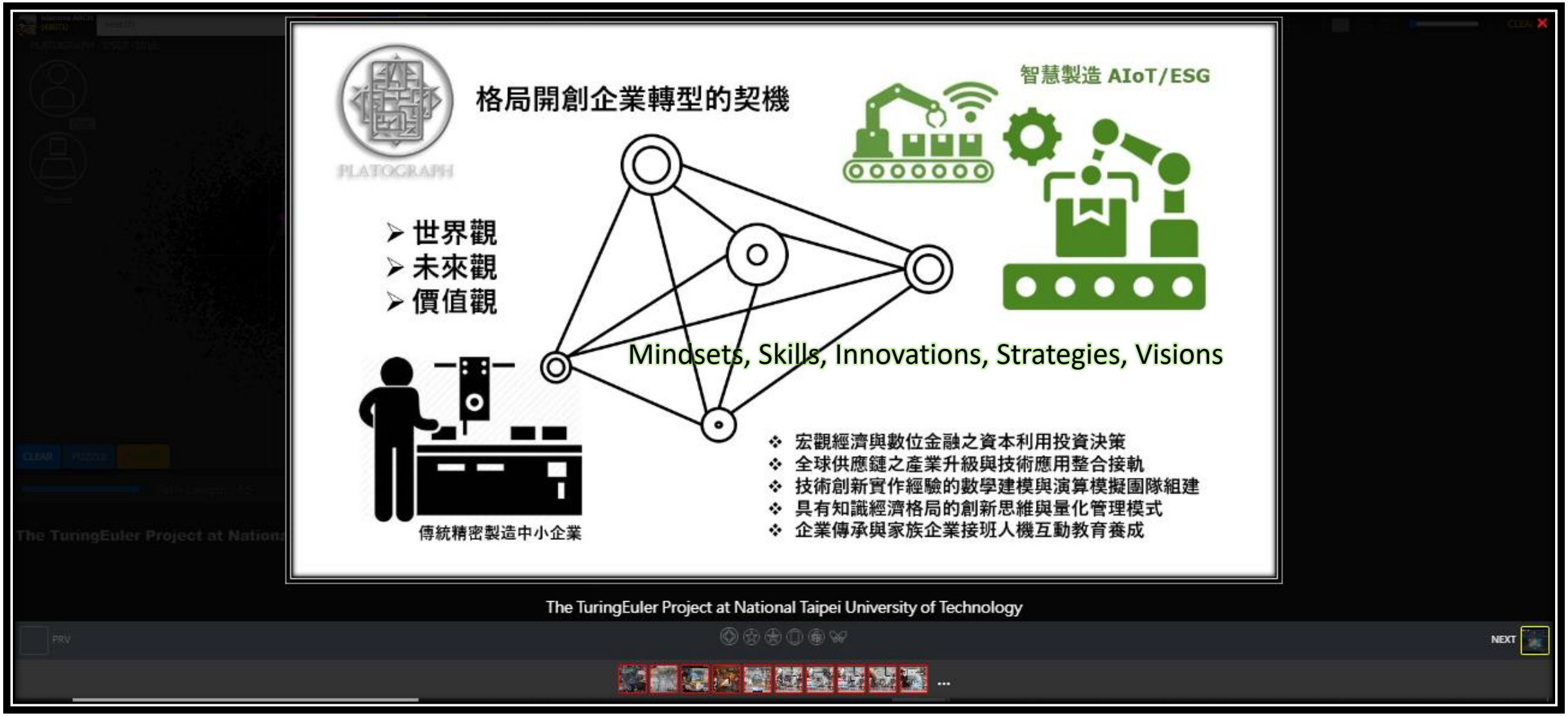
Learning & Coding SVM Algorithms & Applications on Q2



Pathon finding More Related Algorithms & Courses/Courselets



There are Much More to train Employees than just Skills



Civilization Evolution in 200 Dominoes (Historic Events/Topics)

One Last Thing: Bruce's Demo of His MMX for Mars Moonshot