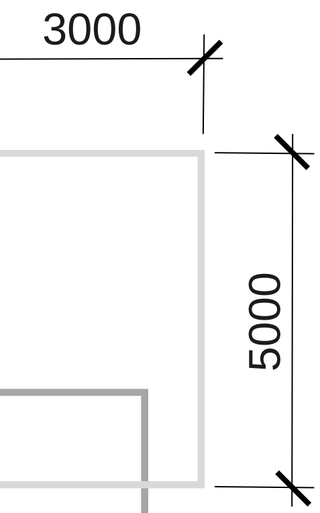
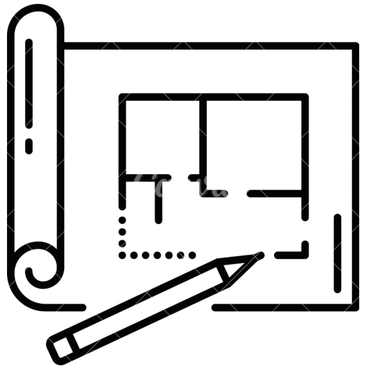
PIPE PLACER

SPEED UP MEP DESIGN PROCESS



Договор

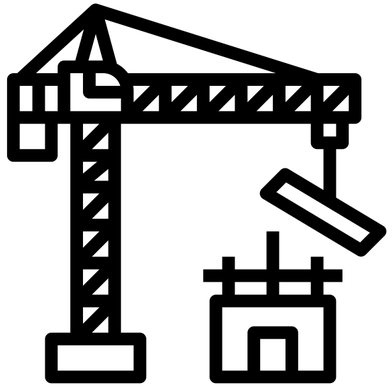
Проектирование



~ 5-30%

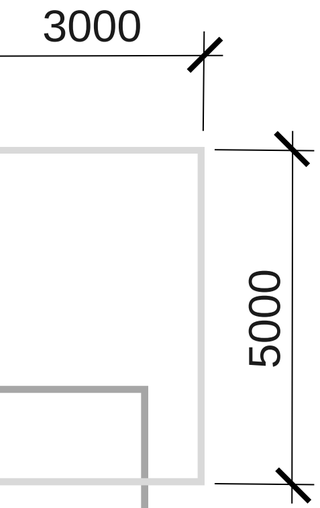
~ 1-5%

Строительство

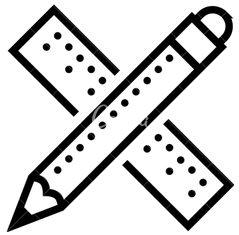


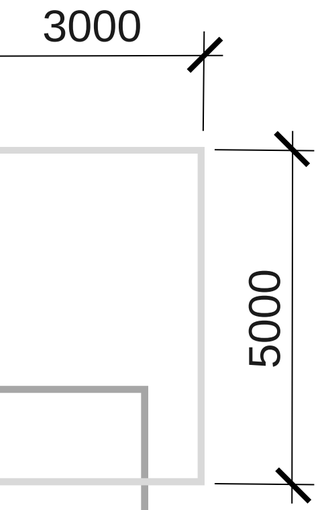
~ 70-95%

~ 95-99%



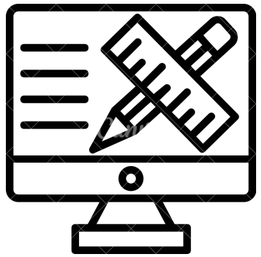
Прошлое





Вчерашний день

CAD

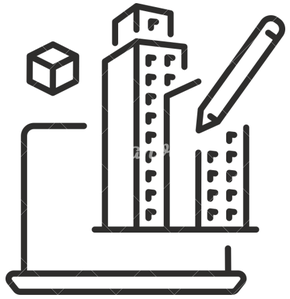


x1

100%

100%

Настоящее



BIM

x1.2-1.5

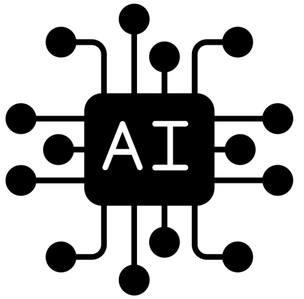
до 50%

до 40%

Будущее

BIM

+

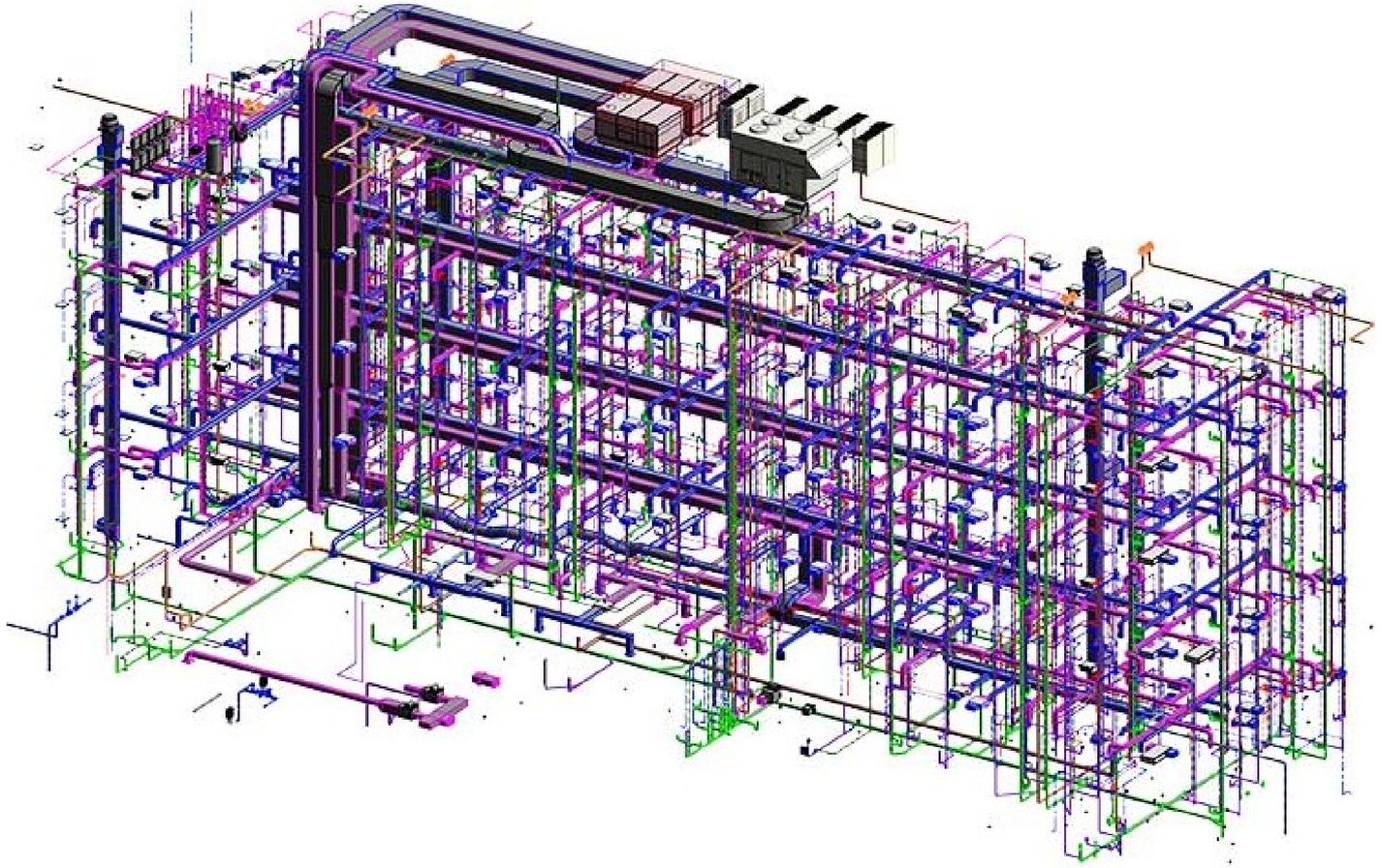


x1.5-N

до 80%

до 70%

Проект сетей здания в BIM



3000

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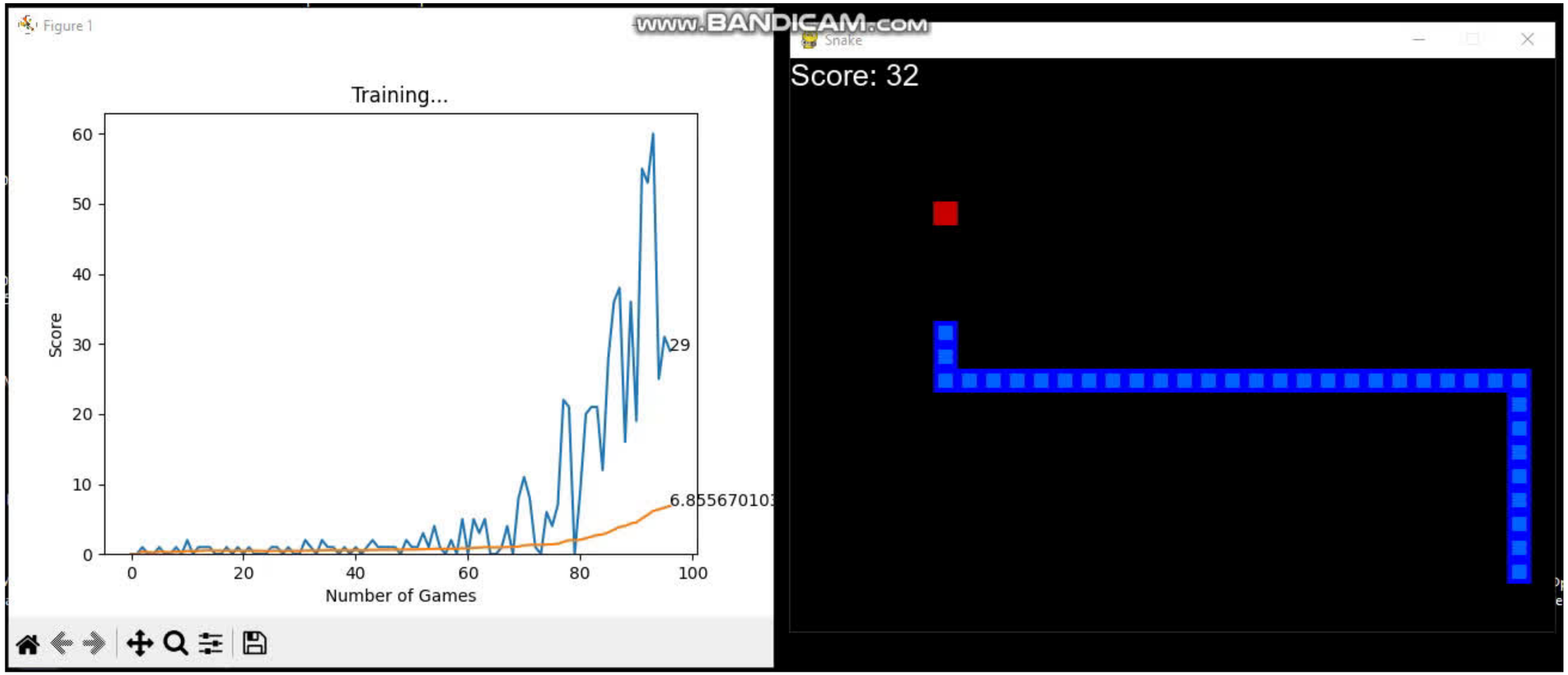
Проект 2D змейки управляемой нейросетью



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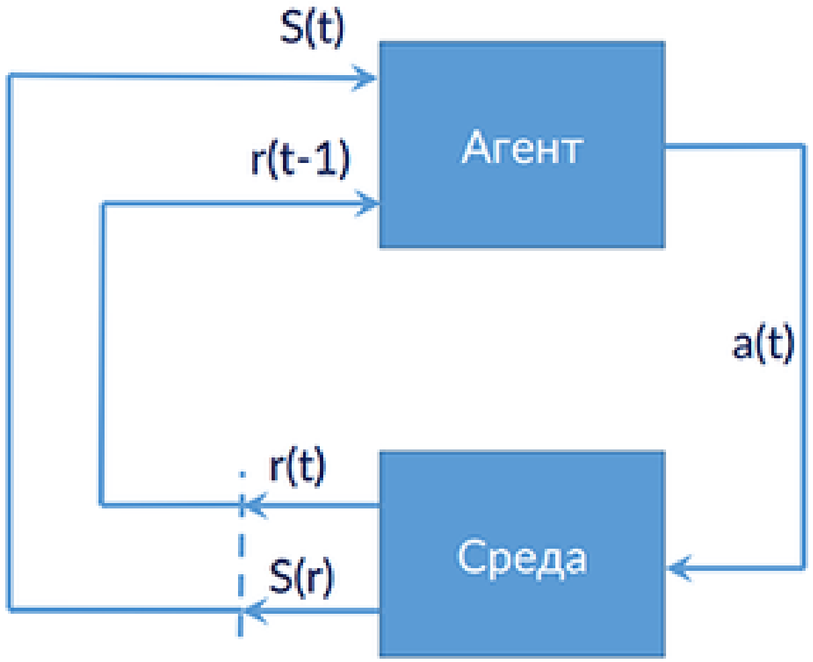
Обучение с подкреплением



Технологии

Среда

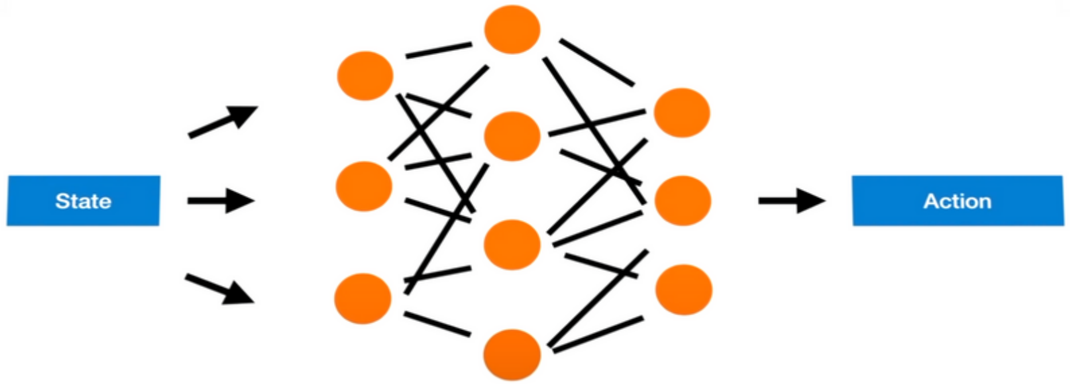
Фрэймворк

PyTorch

3000

5000

Модель DQN



Псевдокод

Agent

- game
- model

Training:

- state = get_state(game)
- action = get_move(state):
  - model.predict()
- reward, game_over, score = game.play_step(action)
- new_state = get_state(game)
- remember
- model.train()

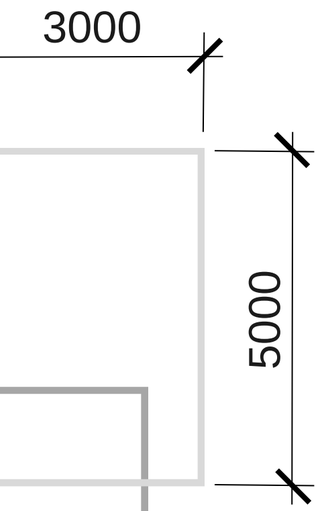
Game (Pygame)

- play_step(action)
  -> reward, game_over, score

Model (PyTorch)

Linear_QNet (DQN)

- model.predict(state)
  -> action



Описание параметров

Action

[1, 0, 0] -> straight
[0, 1, 0] -> right turn
[0, 0, 1] -> left turn

Reward

- eat food: +10
- game over: -10
- else: 0

3000

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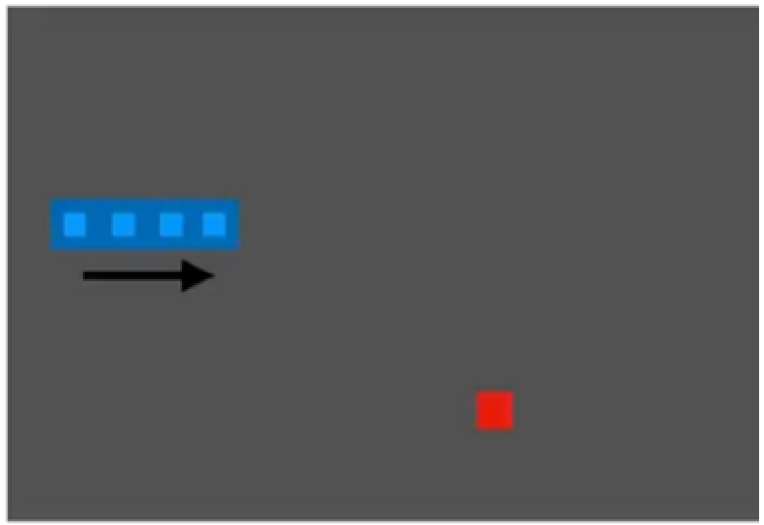
State (11 values)

[danger straight, danger right, danger left,

direction left, direction right,
direction up, direction down,

food left, food right,
food up, food down
]



[0, 0, 0,

0, 1, 0, 0,

0, 1, 0, 1]

Процесс обучения

(Deep) Q Learning

Q Value = Quality of action

0. Init Q Value (= init model)
1. Choose action (model.predict(state)) (or random move)
2. Perform action
3. Measure reward
4. Update Q value (+ train model)

Repeat

Q Update Rule Simplified:

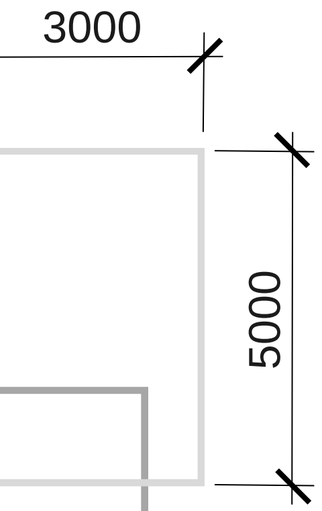
$$Q = model.predict(state_0)$$

$$Q_{new} = R + \gamma \cdot max(Q(state_1))$$

Loss function:

$$loss = (Q_{new} - Q)^2$$

Mean Squared Error



Уравнение Беллмана

$$NewQ(s,a) = Q(s,a) + \alpha[R(s,a) + \gamma max Q'(s',a') - Q(s,a)]$$

New Q value for that state and that action

Current Q value

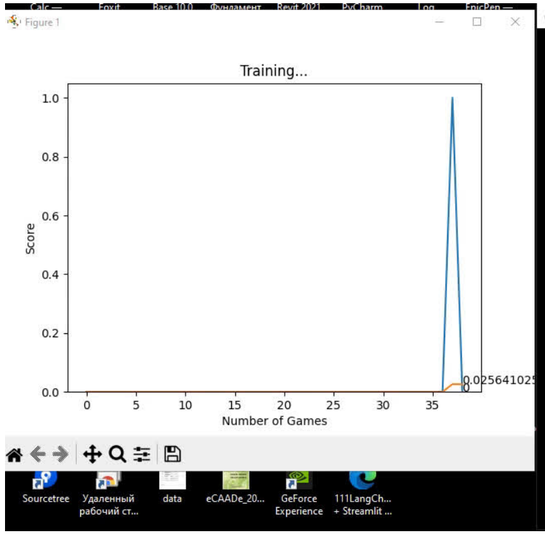
Learning Rate

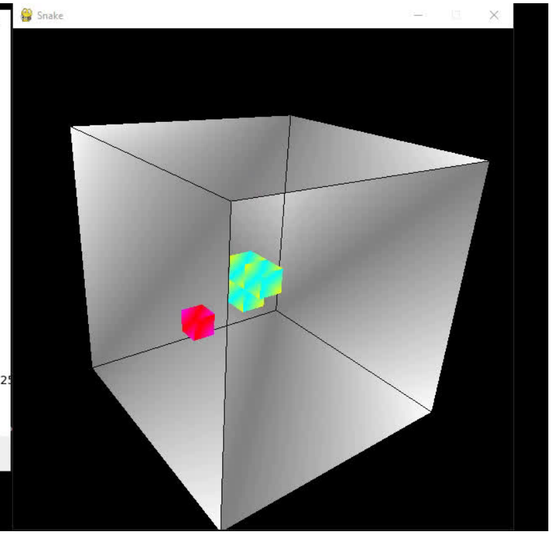
Reward for taking that action at that state

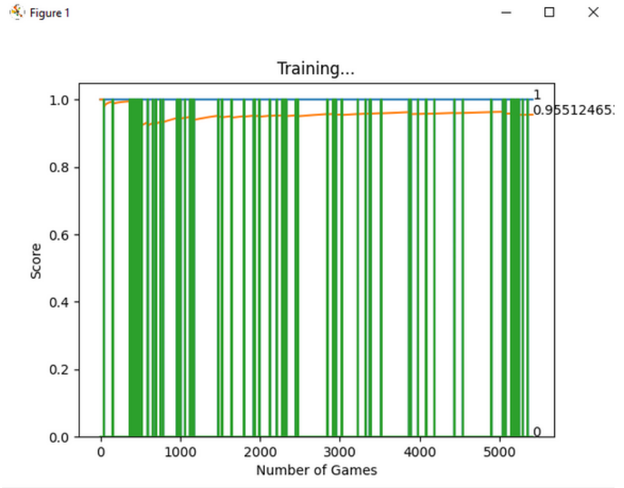
Discount rate

Maximum expected future reward **given the new s' and all possible actions at that new state**

Результаты обучения







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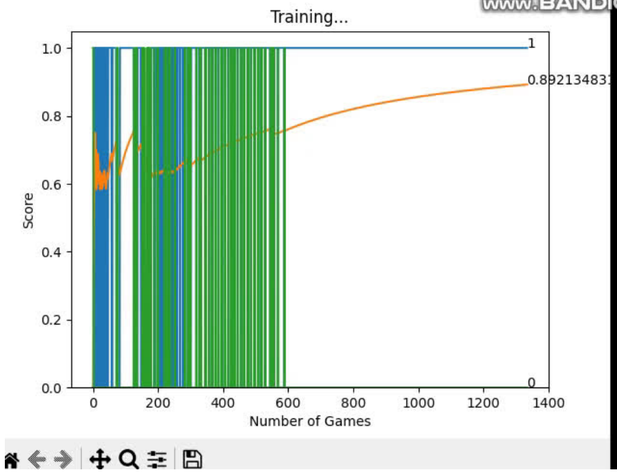

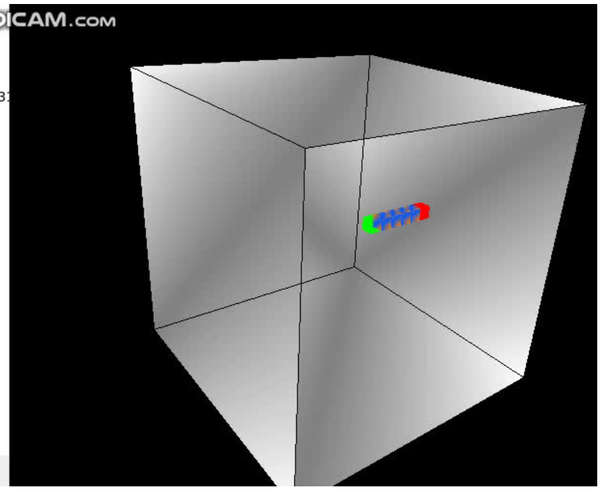

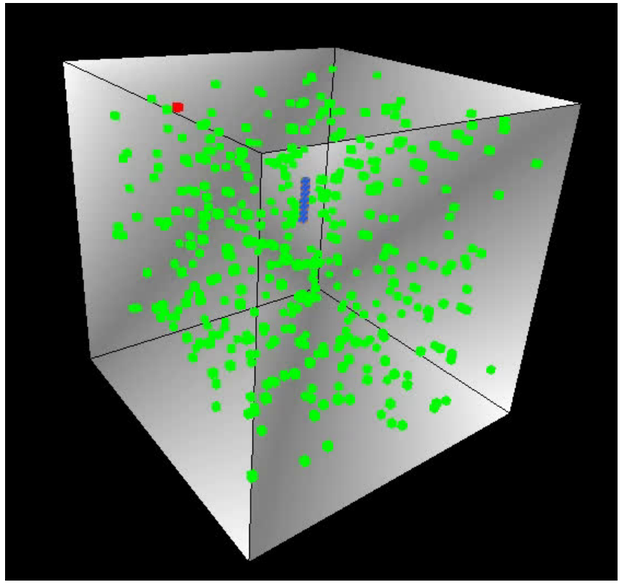

Результаты интеграции в Autodesk Revit

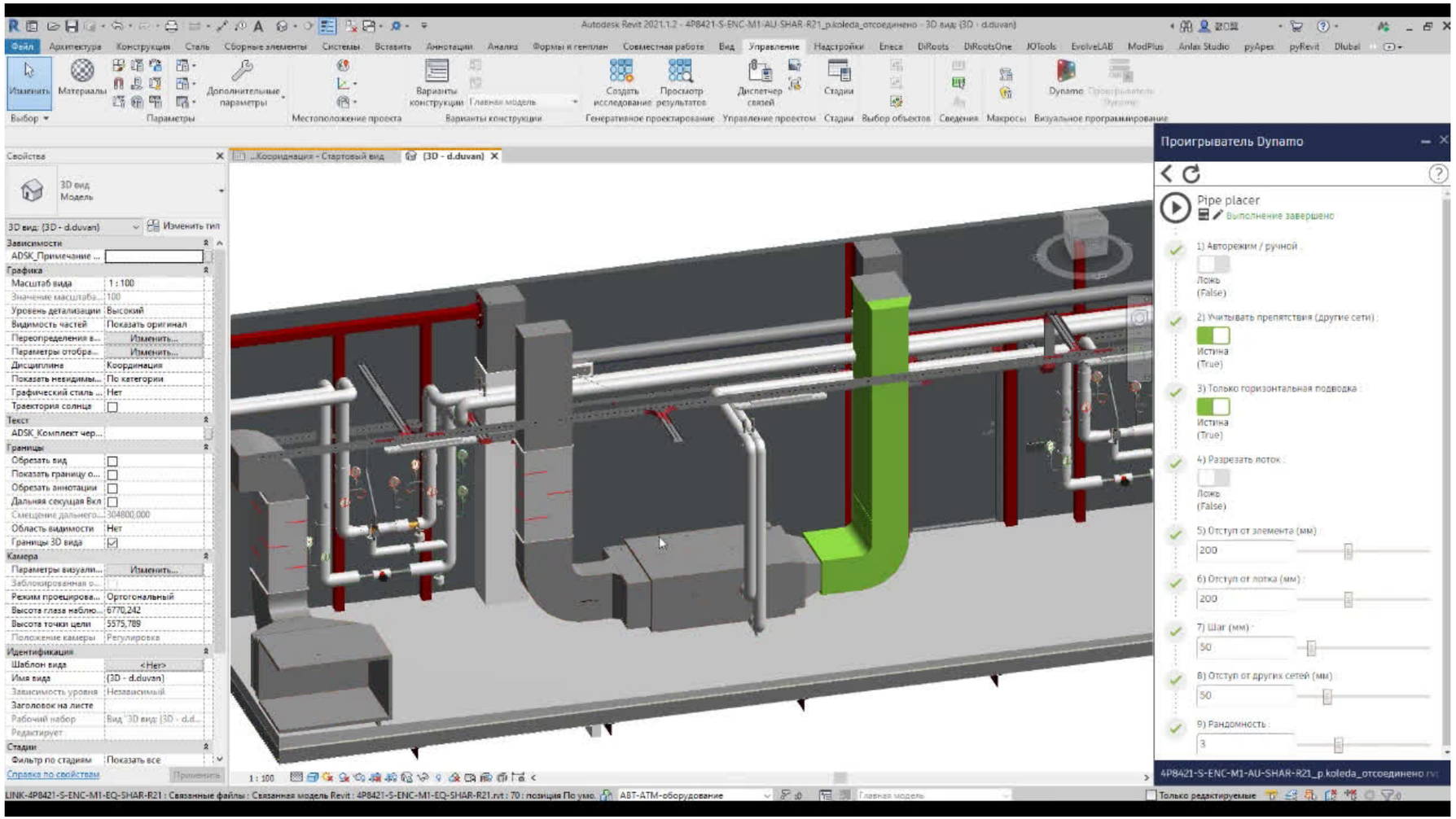

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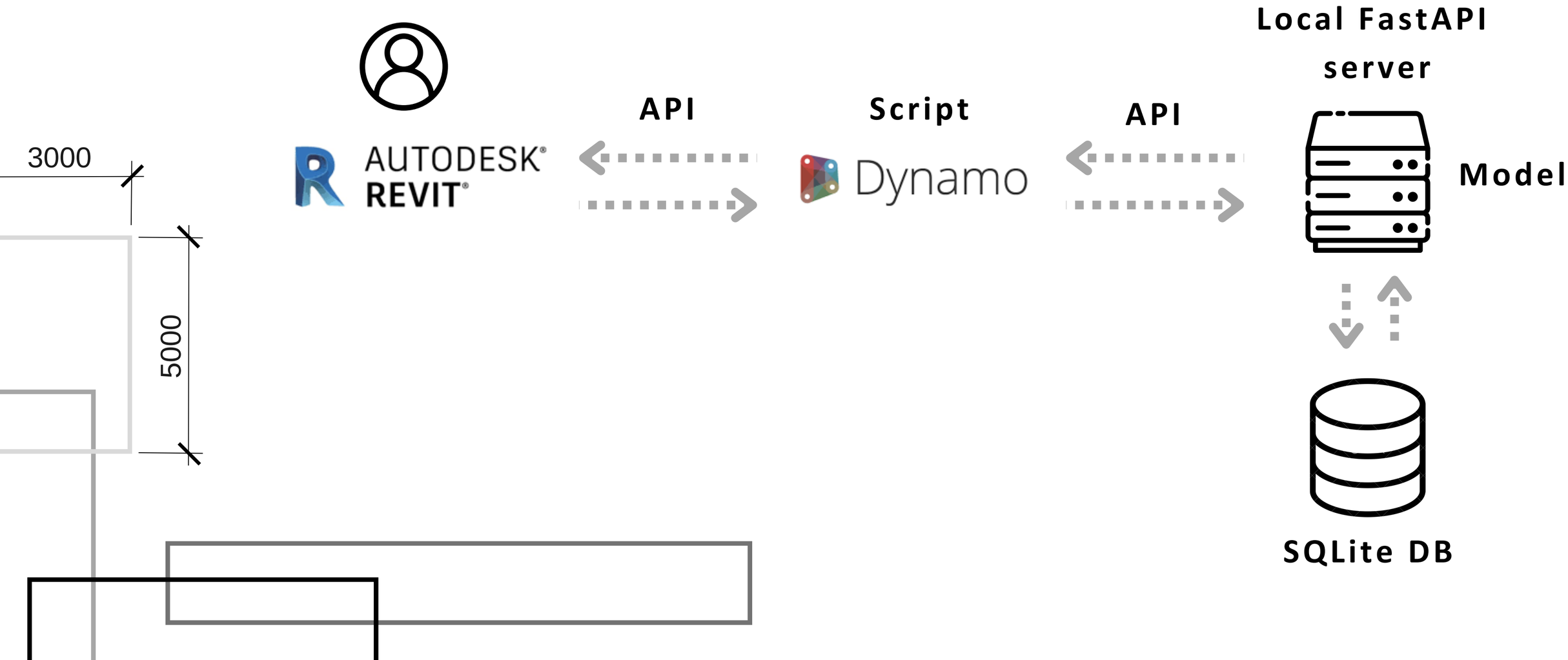
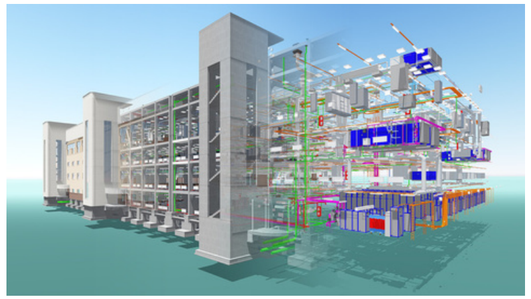
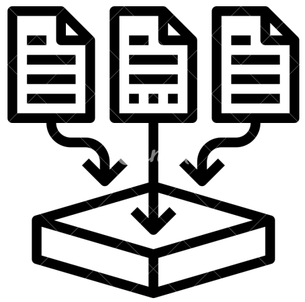
Схема работы



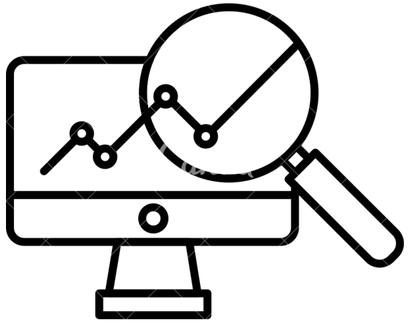
Пути развития:

1) Поиск новых данных

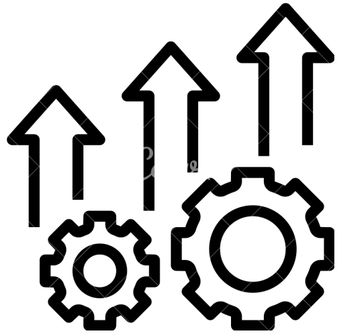




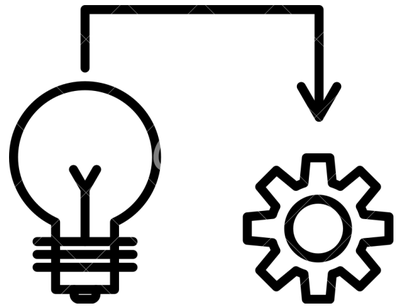
2) Детальный анализ

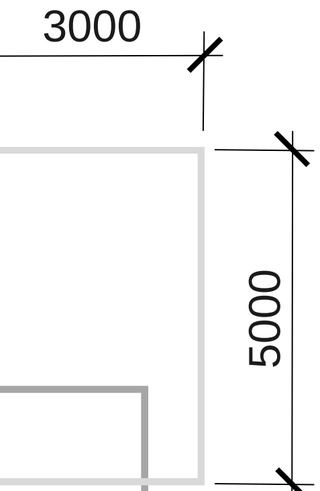


3) Создание/ улучшение алгоритмов



4) Внедрение в рабочие процессы





Спасибо за внимание!