“IntelliOre” Our project overview

Background and Problem

According to the National Institute for Occupational Safety and Health (NIOSH), over 40% of the most serious mining injuries occur when workers are caught in or between machinery. These incidents often involve a body part being trapped, crushed, or pulled into moving equipment.

We became interested in the mining industry after Coach Yoonjung pointed out that the mining industry faces many challenges that artificial intelligence could help address. As we researched further, we began to recognize the risks that mining workers face every day, which are often overlooked in our daily lives. One of our team members personally experienced this reality when her family member suffered a serious arm injury while operating heavy machinery at a mining site. This incident became our motivation to promote the safety of mining workers.

Our Product Idea and Goals

So, we established IntelliOre that focused on improving worker safety. Our goal is to build an AI-powered system that predicts machinery breakdowns using data and verifies whether workers are wearing proper safety gear through image detection. Ultimately, we aim to reduce preventable accidents and create safer mining environments.

The core features of IntelliOre include the analysis and visualization of mining machine data to help workers prevent accidents before they occur. In addition, we aim to implement image detection to verify whether workers are wearing safety gear such as helmets and vests. For our final product, we plan to build a website that integrates these features into human-cented interface. This decision was made because the target users are on-site mining workers who need to quickly understand machine conditions and safety alerts without interpreting complex data.

Our learnings

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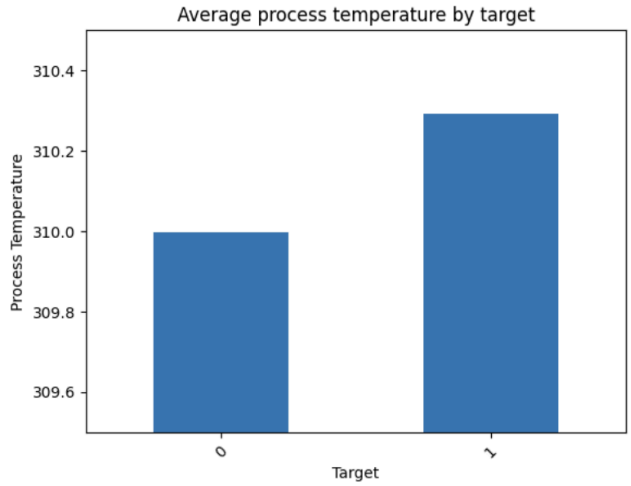
...    UDI Product ID Type  Air temperature [K]  Process temperature [K]  \
0    1     M14860    M                298.1                   308.6
1    2     L47181    L                298.2                   308.7
2    3     L47182    L                298.1                   308.5
3    4     L47183    L                298.2                   308.6
4    5     L47184    L                298.2                   308.7

   Rotational speed [rpm]  Torque [Nm]  Tool wear [min]  Target Failure Type
0                    1551         42.8                0       0   No Failure
1                    1408         46.3                3       0   No Failure
2                    1498         49.4                5       0   No Failure
3                    1433         39.5                7       0   No Failure
4                    1408         40.0                9       0   No Failure
                UDI  Air temperature [K]  Process temperature [K]  \
count  10000.00000          10000.000000              10000.000000
mean    5000.50000            300.004930                310.005560
std     2886.89568              2.000259                  1.483734
min        1.00000            295.300000                305.700000
25%     2500.75000            298.300000                308.800000
50%     5000.50000            300.100000                310.100000
75%     7500.25000            301.500000                311.100000
max    10000.00000            304.500000                313.800000

       Rotational speed [rpm]   Torque [Nm]  Tool wear [min]        Target
count            10000.000000  10000.000000     10000.000000  10000.000000
mean              1538.776100     39.986910       107.951000      0.033900
std                179.284096      9.968934        63.654147      0.180981
min               1168.000000      3.800000         0.000000      0.000000
25%               1423.000000     33.200000        53.000000      0.000000
50%               1503.000000     40.100000       108.000000      0.000000
75%               1612.000000     46.800000       162.000000      0.000000
max               2886.000000     76.600000       253.000000      1.000000
```

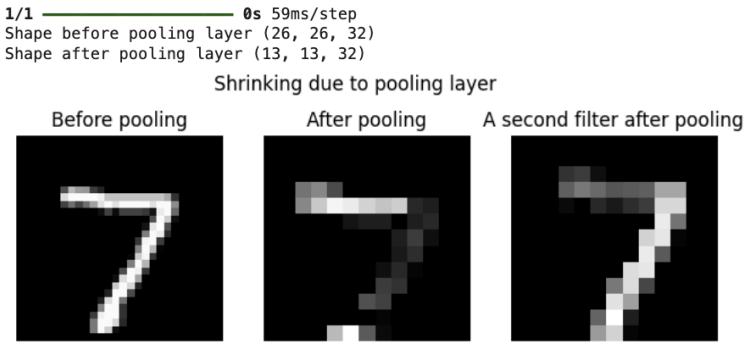
Screenshot of predictive maintenance data usage



Bar graph showing the average temperature by target (0 = Normal, 1 = Failure)

To implement these features, we began our technical journey by working with predictive maintenance data as a learning dataset. This dataset includes machine operating conditions such as air temperature, process temperature, rotational speed, torque, tool wear, and failure

type. We visualized the data using various graphs to identify patterns related to machine breakdown status and to strengthen our coding skills for product development.



Screenshot of MNIST dataset usage for a CNN model

Screenshot of CIFAR dataset usage for a CNN model

We also studied Convolutional Neural Networks (CNNs), which is critical for developing our safety gear detection feature. During this process, we worked with both the MNIST and CIFAR datasets. Using the MNIST dataset, which contains grayscale images of handwritten digits, we trained and tested our model. This allowed us to interpret prediction confidence levels and understand how the model assigns probabilities to each possible output. We also experimented with the CIFAR dataset, which consists of colored images of real-world objects. Through confusion matrix analysis, we observed that certain classes were predicted accurately, while others were frequently misclassified, and gained insight into how to improve model performance.

Logo of IntelliOre

Screenshot of IntelliOre's business website

In addition to the technical development, we also established the brand identity of IntelliOre. We created a logo that clearly represents our idea and selected a brand color that conveys trust and protection. Additionally, we began building a website to introduce IntelliOre and help users quickly understand who we are.

Our challenges

We faced many challenges throughout the startup process. One major challenge was understanding machine learning concepts. It was our first time working with CNNs, from learning the theory to applying them in practice. However, with the support of Coach Ella and additional learning resources, we were able to overcome this challenge. We learned the importance of writing concise code and adding clear comments to make it easier to understand how different parts of the code function.

Future plans

Our future plans for IntelliOre focus on further technical development. We plan to build the MVP, the minimum viable version of the product, incorporating the core features. After completing MVP, we will gather feedback from Mentor James, an engineering professional who works in real mining sites and potentially from workers in the sites. We aim to collect feedback on user experience and the overall effectiveness of the product, and then make improvements based on those insights. Furthermore, to expand our business presence, we plan to officially launch our business website and promote IntelliOre through LinkedIn activity to reach a broader potential customer base. By promoting worker safety through innovative technology we hope to make a positive impact in the mining industry and contribute to creating safer working environments for everyone.