Hello everyone, we are BayesGenes. Thank you for taking the time to join us today, we will do our best to make sure your time spent with us is worth it.

And we will start by showing you this.

This!

Is how much money we will generate the company, so stick in with us because this is going to be interesting.

Here is the problem. This graph represents the timeline of the inspections between 2014 and 2016 for a natural gas pipe in Madrid. As you can see, the team performed an inspection in 2014. In 2015, this gas pipe leaked, but the inspection team did not come back to inspect it until 2016.During that time, the pipe incurred a loss of around 820000 Euros considering the gas volume cost and the repairing cost. It also released 6 tons of CO2 in Madrid.

In some cases, this type of leaks have a greater damage incurring fines and litigation costs to the company responsible for them, in addition to a negative reputational impact on the company, leading to a decrease in demand, customers churn and a drastic decrease in revenue.

Now imagine, this pipe was to be inspected right here.

In 2015, when it started leaking.

All these damages could have been saved, and in fact this is possible.

Today we present the BayesGenes inspection strategy. An optimal gas pipes inspection strategy, powered up by a fast and scalable AI model that predicts gas pipe leakages, along with a genetic algorithm that sets the most optimal strategy considering all the geographical and scheduling constraints.

The name is cool, but let’s see how performing is this inspection strategy.

Our inspection strategy relies first on an AI model which consists of four of the most performing machine learning models ensembled together, solely for the purpose of predicting gaz pipe leakages. Not only this model has achieved the first score in the competition with an accuracy of 90.5%, but in fact the model performs predictions in less than 3 seconds, it is scalable and robust no matter the inputs.

Now you may be interested in knowing what makes this model so performing.

Well, to build this model, we were given a dataset that contains variables of properties of more than 1 million pipes with details about each pipe inspection throughout the years.

In our first approach with the data, we found some pipes with unusual values. As you can appreciate in this plot, there are pipes said to be built in 2050 and others that are said to be inspected before even to be built. Therefore, we imputed these pipes with the right values of the year they are built in. Following up, we continued setting consistency conditions and removed more minory rows.

Moving on, we added some features that we thought our model should consider. Out of internet resources, we could build a program that gave us the population density for each town; we also added information on the thickness of the pipe, the gas flow rate, as well as time series variables translating in the year period. We also encoded some categorical variables we had to dummies such as the province, the material of the pipe, and the gas type.

After all this data cleaning and feature engineering, we hyper tuned the parameters and that that is how we built this great model. (To develop).

After getting the predictions from our model on when and where there will happen a gaz pipe leakage. We feed this information into our BG algorithms which consist of a genetic algorithm.

The algorithm starts by generating a population of potential inspection strategies, represented as sets of rules that include the town proximity, the prioritization of pipes basing on the leakage costs, and repair costs.

More importantly, it considers the average number of pipes to be possibly inspected per town and year, reflecting the feasibility constraint and the teams availability.

The algorithm then evaluates each strategy in the population by calculating how well it meets the desired criteria. Based on the evaluation results, the algorithm selects the best-performing strategies and combines them to create new, potentially better strategies. This process of selection and combination is similar to natural selection and genetic crossover.

Over time, the algorithm evolves the population of inspection strategies towards the optimal solution, continuously adjusting the rules and criteria until the best strategy is found. The final result is a set of rules that dictate the optimal inspection strategy, taking into account all the factors mentioned, for ensuring the safe and efficient operation of the gas pipeline network.

Know you know about the BG inspection strategy, you heard about its performance. However we believe that in order to choose a product you need to see it, so let’s see how this model performs and how it translates to a real business solution.

Exclusively, we developed a platform designed to both fit the technical, operations and business teams in the company. Our landing page gives an overview on the strategy performance over the map of Spain. The platform allows selecting the timeline and one of the different metrics including the Loss in gas leakage reduced, the loss in Euros reduced, the repairing costs reduced, and even all of them. This friendly representation of the strategy, could allow the operations team, to improve the inspection strategy further over the years.

Then we find a calendar, very useful for the inspection teams, where they can find the pipe Ids to inspect for each day, in each town.

Not only this, in fact the operation and business teams can look up their insights from the map, and take them a step further through using our dashboard, that allows to visualize every specific variable over particular towns, timelines and proposing a variety of plots.

In any case, our platform provides predefined important metrics for the business and operations teams. As you can see, we have an automatic plot of the 20 towns that incur the higher loss costs, along with the corresponding map and another predefined graph that represents the 20 pipes that incur the highest losses.

Now, you may think the juicy part is done but yet the best is still coming. We all saw this nice platform that predicts pipe gas leakages amazingly. It is time though to see the impact of its predictions in saving the environment from one side and saving money for the company from another side.

If you look at this plot here, it represents the cost in million Euros in terms of gas leakage between 2010 and 2020. The bars you see in red represent the current strategy adopted by the company, and as you can guess the bars in green represent the costs applying the BayesGenes inspection strategy. So here is what you want to hear, with our strategy around 8 million Euros have been saved to the company. Because less gas was emitted in the air, our strategy also reduced the carbon footprint from 512 tons to 465 tons, so around 50 tons of carbon footprint not released.

This is great for the environment but not only that. In fact less emissions have a great benefit for the company because all gas pipe companies operating in Europe are required to report their emissions and they receive tradeable allowances basing on their reports, which in this case means we allow the company more income opportunities.

And there is one last thing; we believe that with more available data such as the number of teams, their location, and more. The BG inspection strategy could improve making more revenue and making a step towards greater sustainability. So to finish, we will leave you with this QR code to enjoy our platform. Thank you very much for your time.