ML-Ops (stands for Machine Learning Operations) is a systematic process of the Machine Learning development that includes all steps from data aggregation to the ML model deployment and monitoring.

Like conveyor belt (assembly line) system was developed in the automobiles industry, the informatics processes also needed the process definition that would allow to increase the efficiency, speed, and security of software development. Since DevOps term was first coined in 2009, another term, ML-Ops, was applied since 2015 for highlighting the Machine Learning lifecycle that is aiming to scale for business applications.

MLOps process incorporates these methodologies and principles:

* Version control - tracking so the results could be reproduces or previous version restored if necessary
* Automation - of various stages from data ingestion, preprocessing to validation and deployment to ensure repeatability, consistency, and scalability.
* Model governance – collaboration between stakeholders, using clear documentation, ensuring data protection
* CI/CD (commonly used in DevOps) - continuous integration (CI), continuous delivery (CD) – two concepts originating from software system development (DevOps), and also applied in MLOps.  
  CI is about testing and validating code, components, data, data schemas, and models.  
  CD is about a ML system that should automatically deploy model prediction service.
* Continuous training (CT) - iterative improvements on each model version by automatic retraining and serving the models. CT is a new property, unique to ML systems.

Common steps in the MLOps process:

1. Preparing the data for modelling and sharing it with the teams
2. Build and train models using Python and external libraries
3. Deploy models so they could be accessed, tested and monitored
4. Improve models with automation
5. Automate the ML pipelines to the entire ML lifecycle to attain highly efficient process.

It is interesting to mention that only a small fraction of a real-world ML system is composed of the ML code. The required surrounding elements are vast and complex.

Elements for ML systems. Adapted from [Hidden Technical Debt in Machine Learning Systems](https://papers.nips.cc/paper/5656-hidden-technical-debt-in-machine-learning-systems.pdf), source: [Google](https://cloud.google.com/architecture/mlops-continuous-delivery-and-automation-pipelines-in-machine-learning)

A close-up of a diagram

Description automatically generated

[MLOps and the evolution of data science - IBM Blog](https://www.ibm.com/blog/mlops-and-the-evolution-of-data-science/)

[What is MLOps? - Machine Learning Operations Explained - AWS (amazon.com)](https://aws.amazon.com/what-is/mlops/#:~:text=Machine%20learning%20operations%20(MLOps)%20are,deliver%20value%20to%20your%20customers.)

[MLOps: Continuous delivery and automation pipelines in machine learning  |  Cloud Architecture Center  |  Google Cloud](https://cloud.google.com/architecture/mlops-continuous-delivery-and-automation-pipelines-in-machine-learning#data_science_steps_for_ml)