

Add time-series anomaly detection support to Anomalib

Prerequisite Task:

- [#1856](#) Merged.
- [#1558](#) Working.

About Me:

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Short Bio:

I am pursuing my Master's degree at Concordia University, building upon my background in Computer Science and Engineering with a focus on Computer Vision and Pattern Recognition during my undergraduate studies. Currently, I am working as a Research Assistant at Concordia University, where my research interests span across multiple domains. Specifically, my areas of research include Computer Vision, Anomaly Detection, Adversarial Attacks, and Graph Neural Networks.

My Experience:

I have been coding in Python since the last five years. I am also familiar with C, Java and SQL. I work on Mac-OS and Ubuntu which is a Debian based Linux distribution.

I have a considerable amount of experience in conducting research, particularly in the field of computer vision. I have authored several publications focusing on various computer vision tasks. One of my recent projects involved creating a dataset for autonomous vehicles. In this project, I employed three approaches to annotate the data. Firstly, annotations were performed manually by humans. Secondly, annotations were generated using a detection model, followed by validation of these annotations. Lastly, annotations were generated fully automatically by a model. [Paper](#).

Another project I participated in focused on knowledge distillation, specifically applying this method to melanoma classification. Recognizing the significance of lightweight models in the medical domain, we aimed to develop a compact model capable of accurately classifying melanoma disease with high precision. [Paper](#).

Project

I want to work on this project **“Add time-series anomaly detection support to Anomalib.”**

Overview:

The goal of this project is to add support for anomaly detection in 1D (time-series) data, such as audio signals. The following components would need to be added to achieve time-series anomaly detection support:

Deliverables:

- Create Pytorch-Lightning compatible dataset adapters for reading 1D-data.
- At least 1 fully functional time-series anomaly detection model.
- Metrics and visualization utilities for qualitative and quantitative evaluation of the model’s performance.
- A blog which provides an overview and step-by-step demo.

Why did you choose this specific idea?

- As previously stated, my current research focuses on anomaly detection, and I have experience in addressing anomalies within time-series data. Engaging in this project will further enhance my expertise in this field, allowing me to delve into cutting-edge methodologies and implementations. This opportunity will not only deepen my understanding but also refine my coding skills through practical application of advanced techniques.

How much time do you plan to invest in the project?

- For this project, I am willing to invest 25 - 30 hours per week. This would be adjustable based on my progress and mentor's feedback.

Provide an abstract of the solution:

The aim of this project is to implement an anomaly detection method for time series data. For that, I will be employ the [SINBAD \(Set INspection Based Aomalies Detection\)](#) technique. The key assumption behind this method is that the distribution of elements within a sample holds greater significance in identifying anomalies than the specific order of those elements. Each element is extracted using a pre-trained network, and for a set of features, the method calculates the proportion of elements falling into various distributions. Subsequently, anomalies are evaluated by applying density estimation to this set representation. The approach is capable of identifying logical anomalies at the image level and time series anomalies at the series level and showing state-of-the-art results on different datasets.

Timeline and Deliverables

May 1	Proposal Accepted/ Rejected	<ul style="list-style-type: none">● Discussing the project with mentors.● Finalize the project implementation.
May 26	Community Bonding Period	<ul style="list-style-type: none">● Get to know mentor.● Read documentation, get up to speed to begin working on their projects.
May 27	Pre - work completed	Coding officially begins!
June 10	Milestone # 1	<ul style="list-style-type: none">● Discuss about the model implementation.● Discuss about time series datasets.
June 24	Milestone # 2	<ul style="list-style-type: none">● Implementing the model
July 12	Midterm evaluation deadline	<ul style="list-style-type: none">● Planning to finish the model implementation.
July 26	Milestone # 3	<ul style="list-style-type: none">● Write some test cases
August 10	Milestone # 4	<ul style="list-style-type: none">● Test the code on finalize mode.
August 26	Final Week	<ul style="list-style-type: none">● Submit the final code work.

General questions

How do you know OpenVINO?

- During one of my projects, I was exploring various frameworks to benchmark my model with and that's how I got to know about OpenVINO for the first time. It contains pre-trained deep learning models for various computer vision tasks, such as object detection, classification, segmentation, and more. These models can be readily used or fine-tuned for specific applications. I explored a bunch of pre-trained models by OpenVINO.

What do you know about OpenVINO?

- OpenVINO, which stands for Open Visual Inference and Neural Network Optimization, represents a toolkit crafted by Intel with the aim of optimizing deep learning models for inference across a diverse array of Intel hardware, spanning CPUs, GPUs, FPGAs, and VPUs (Vision Processing Units). This toolkit empowers developers to deploy pre-trained deep learning models for various tasks such as computer vision, automatic speech recognition, and natural language processing with greater efficiency, thanks to its utilization of hardware acceleration.

Have you already contributed to the OpenVINO project? (please include links)

- Yes, I have contributed to the [anomalib](#) project.
- [#1856](#) Merged.
- [#1558](#) Working.

How could you apply it to your professional development?

- Anomaly detection is a fundamental challenge present across various domains, such as Finance, Automated Factories, Sensors, Image and Video Processing, and Audio Analysis. Upon completion of this project, I anticipate gaining a comprehensive grasp of anomaly detection that can be applied across diverse fields. This experience will not only enhance my ability to navigate extensive codebases but also improve my teamwork and communication skills with mentors. These acquired skills are invaluable for advancing my professional career.

Describe any other career development plan you have for the summer in addition to GSoC.

- I haven't decided yet. My main focus would be this project.

Why should we pick you?

- The reason I selected this project initially stems from my previous experience in anomaly detection. Given the opportunity, I am committed to contributing to this project to the fullest extent, as it aligns with my aspirations for professional growth. If given a chance, I'll contribute to this project to the maximum extent possible which will help me in growing skills for my professional career path. I also wanted to contribute to the Anomalib community for so long and through this opportunity. I'm also interested in helping people get started with Anomalib.