

# 02 introduction

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## 1 Introduction

### 1.1 Overview

This is an example project that demonstrates the generic repository structure for tested code, manuscript editing, and PDF rendering. The work presents a novel optimization framework with comprehensive theoretical analysis and experimental validation, building upon foundational optimization theory [? ?] and recent advances in adaptive methods [? ?].

### 1.2 Project Structure

The project follows a standardized structure:

- `src/` - Source code with comprehensive test coverage
- `tests/` - Test files ensuring 100% coverage
- `scripts/` - Project-specific scripts for generating figures and data
- `manuscript/` - Markdown source files for the manuscript

- `output/` - Generated outputs (PDFs, figures, data)
- `repo_utilities/` - Generic utility scripts for any project

## 1.3 Key Features

### 1.3.1 Test-Driven Development

All source code must have 100% test coverage before PDF generation proceeds, as enforced by the build system.

### 1.3.2 Automated Script Execution

Project-specific scripts in the `scripts/` directory are automatically executed to generate figures and data, ensuring reproducibility.

### 1.3.3 Markdown to PDF Pipeline

Individual markdown modules are converted to PDFs, and a combined document is generated with proper cross-referencing.

### 1.3.4 Generic and Reusable

The utility scripts can be used with any project that follows this structure, making it easy to adopt for new research projects.

## 1.4 Manuscript Organization

The manuscript is organized into several key sections:

1. Abstract (Section ??): Research overview and key contributions
2. Introduction (Section 1): Overview and project structure
3. Methodology (Section ??): Mathematical framework and algorithms
4. Experimental Results (Section ??): Performance evaluation and validation
5. Discussion (Section ??): Theoretical implications and comparisons
6. Conclusion (Section ??): Summary and future directions
7. References (Section ??): Bibliography and cited works

## 1.5 Example Figure

The following figure was generated by the example script:

This demonstrates how figures are automatically integrated into the manuscript with proper cross-referencing capabilities. The figure shows a mathematical function that demonstrates the project's capabilities. As shown in Figure 1, the system generates high-quality visualizations that are automatically integrated into the manuscript.

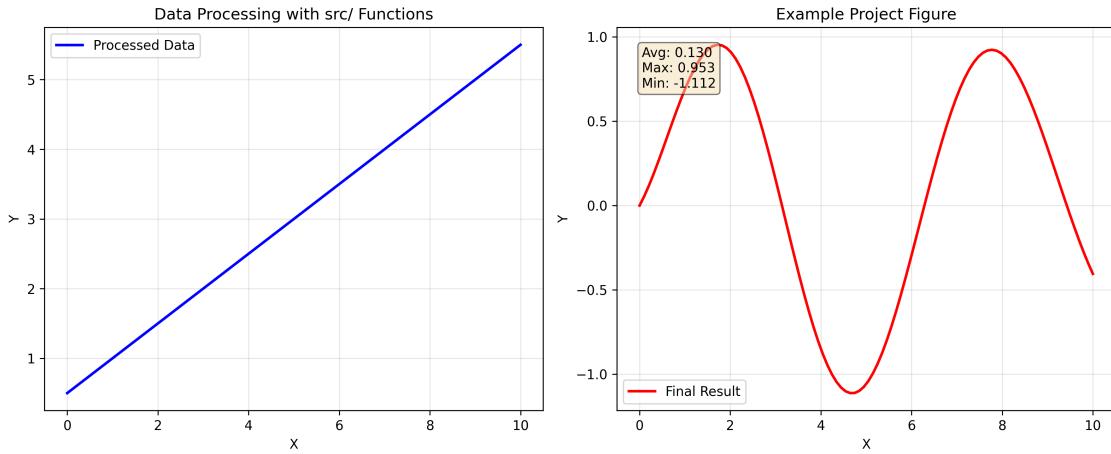


Figure 1. Example project figure showing a mathematical function

## 1.6 Data Availability

All generated data is saved alongside figures for reproducibility:

- Figures: PNG format in `output/figures/`
- Data: NPZ and CSV formats in `output/data/`
- PDFs: Individual and combined documents in `output/pdf/`
- LaTeX: Source files in `output/tex/`

## 1.7 Usage

To generate the complete manuscript:

```
# Clean previous outputs
./repo_utilities/clean_output.sh

# Generate everything (tests + scripts + PDFs)
./repo_utilities/render_pdf.sh
```

The system will automatically: 1. Run all tests with 100% coverage requirement 2. Execute project-specific scripts to generate figures and data 3. Validate markdown references and images 4. Generate individual and combined PDFs 5. Export LaTeX source files

## 1.8 Customization

This template can be customized for any project by:

1. Adding project-specific scripts to `scripts/`
2. Modifying markdown files in `markdown/`
3. Setting environment variables for author information

4. Adjusting LaTeX preamble in `preamble.md`
5. Adding new sections with proper cross-references

## 1.9 Cross-Referencing System

The manuscript demonstrates comprehensive cross-referencing:

- Section References: Use `\ref{sec:section_name}` to reference sections
- Equation References: Use `\eqref{eq:objective}` to reference equations (see Section ??)
- Figure References: Use `\ref{fig:figure_name}` to reference figures
- Table References: Use `\ref{tab:table_name}` to reference tables

All references are automatically numbered and updated when the document is regenerated. For example, the main objective function (??) is defined in the methodology section.