

# pdfa-converter

Oliver Fong

August 20, 2025

## Introduction

This simple project is meant to provide a library and executable which converts PDFs into PDF/A-compliant files for the University of Chicago's DLDC attachment converter project. This project is essentially an extension of John Whittington's Camlpdf library, while also meshing it with Ezxmlm, a version of Xmlm supposedly easier to understand and work with. The program runs as follows:

- 1) Look for non-compliance - which parts of the PDF are non-compliant with the PDF/A standards?
- 2) For whichever aspects of the file are non-compliant, then are they either implemented in the PDF but wrong, or are they simply absent from the file altogether? In the latter case, create the missing piece, insert the relevant objects, and insert/modify references to them from depending objects. In the former case, then parse the existing object, look for what the error is, modify it, and reinsert the modified object altogether. Do this for all pertinent problems, and return the edited file.")

(synopsis "Simple API and executable for converting pdf files into pdfa-compliant files.

## Architecture

The project is organized using several modules:

- **fonts.ml**: Logic and definitions for representing and handling fonts in digital documents.
- **lib.ml**: Provides the core library interface, connecting different parts of the system.
- **outintent.ml**: Manages output intent metadata, something that is often necessary to add to a non-compliant PDF.
- **packet.ml**: Encapsulates XMP packet structures for working with XML and RDF tags. Uses Ezxmlm to interface with existing XML, or to create and insert whatever tags or metadata necessary.
- **utility.ml**: Contains helper functions and reusable routines that support the main modules.

## Implementation Approach

The design follows separation of concerns, with each module serving a clear role. I think the best way to go about organizing this project further is by keeping each specification of PDF/A separate, such that encryption and decryption is its own module and so on and so forth.

## Build and Usage

The project uses Dune for compilation:

```
dune build
```

```
opam exec -- dune ocaml top-module lib/example_module.ml > ./ocamlinit && utop
```

There are some problems using camlpdf with dune, so this latter command is useful for using utop with dune.

## Discussion

**Strengths:** clean modular structure, type safety, reproducible builds. **Limitations:** domain-specific scope, limited user-facing documentation. **Future Work:** extend font coverage, improve packet handling, and add a CLI for testing.

## Conclusion

This project highlights how OCaml and Dune can be combined to create a modular, type-safe system for managing fonts, packets, and output intent metadata. It provides a foundation for further development into a more general-purpose document and data toolkit.