AutoCAD automation through Python scripting

Let Python do the job for you

34th INGEGRAF

Antonio Fernández[1], Lucía Díaz Vilariño[1], Francesco Bianconi[2]

[1]Universidade de Vigo, [2]Università degli Studi di Perugia

antfdez@uvigo.es antfdez.webs.uvigo.es tonechas

Outline

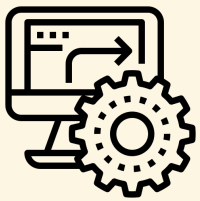
1. Introduction
2. Method
3. Results
4. Discussion

Motivation

Why automate tasks in design workflows?

- Increase efficiency
- Improve accuracy
- Ensure consistency

AutoCAD



What can be automated?

- Adding, removing, and editing elements
- Layer management and configuration
- Import/export from/to other formats
- Block creation and handling

Automation via AutoLISP

Pros

- Native to AutoCAD (since the 1980s)
- Lightweight and fast for small tasks

Cons

- Difficult to read and maintain
- Not ideal for complex workflows

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```
(defun c:xlay ()
  (vl-load-com)
  (setq ms (vla-get-ModelSpace
             (vla-get-ActiveDocument
               (vlax-get-acad-object))))
  (vlax-for ent ms
    (if (/= (vla-get-Layer ent) "MyLayer")
      (vla-put-Layer ent "MyLayer")))
  (princ)
)
```

Automation via VBA and ActiveX

Pros

- Provides structured access to AutoCAD objects
- Integrates with other Windows apps

Cons

- Limited scalability and integration
- Deprecated and no longer maintained

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```
Sub SetLayer()
  Dim ent As AcadEntity
  For Each ent In ThisDrawing.ModelSpace
    If ent.Layer <> "MyLayer" Then
      ent.Layer = "MyLayer"
    End If
  Next
End Sub
```

Automation via C++ and ObjectARX

Pros

- Full access to AutoCAD API and internals
- High performance and scalability

Cons

- Requires advanced C++ programming skills
- Longer development and debugging time

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```
void SetLayer(AcDbDatabase* db) {
  AcDbBlockTableRecord* ms;
  db->getBlockTableRecord(
    ACDB_MODEL_SPACE,
    ms, AcDb::kForWrite);
  AcDbEntity* ent;
  for (auto it = ms->begin();
       it != ms->end(); ++it) {
    ms->getAt(*it, ent, AcDb::kForWrite);
    if (ent->layer() != "MyLayer")
      ent->setLayer("MyLayer");
    ent->close();
  }
  ms->close();
}
```

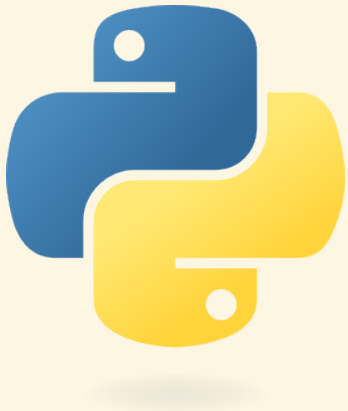
Automation via Python scripting

Pros

- Clear and readable syntax
- Rich ecosystem of libraries
- Suitable for data and AI tasks
- Cross-platform compatibility

Cons

- No direct native API
- Limited access to advanced features
- Needs external package



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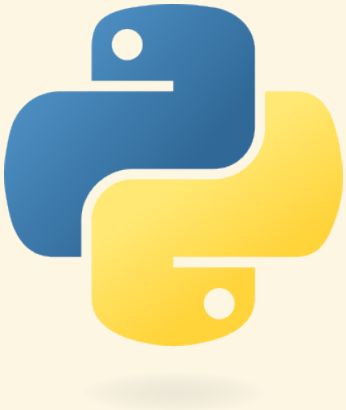

```python
from pyautocad import Autocad

acad = Autocad()
for obj in acad.iter_objects():
    if obj.Layer != "MyLayer":
        obj.Layer = "MyLayer"
```

Research question

Common packages

- `win32com`
- `pyautocad`
- `ezdxf`
- `pyautogui`

What is the most convenient package?

Moving on to...

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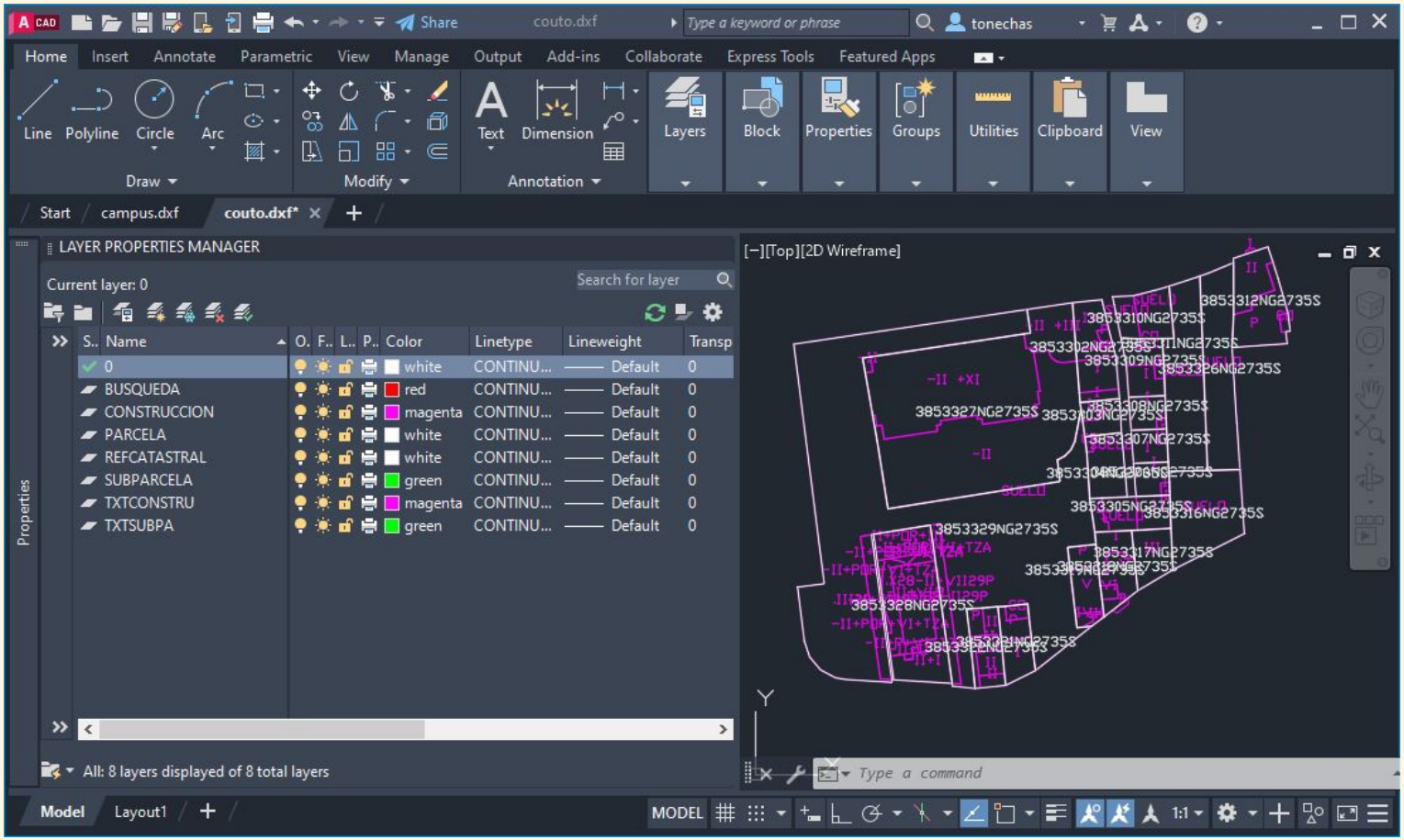
Case study

Add the prefix CADASTRE_ to all layer names in a drawing downloaded from the Spanish cadastre



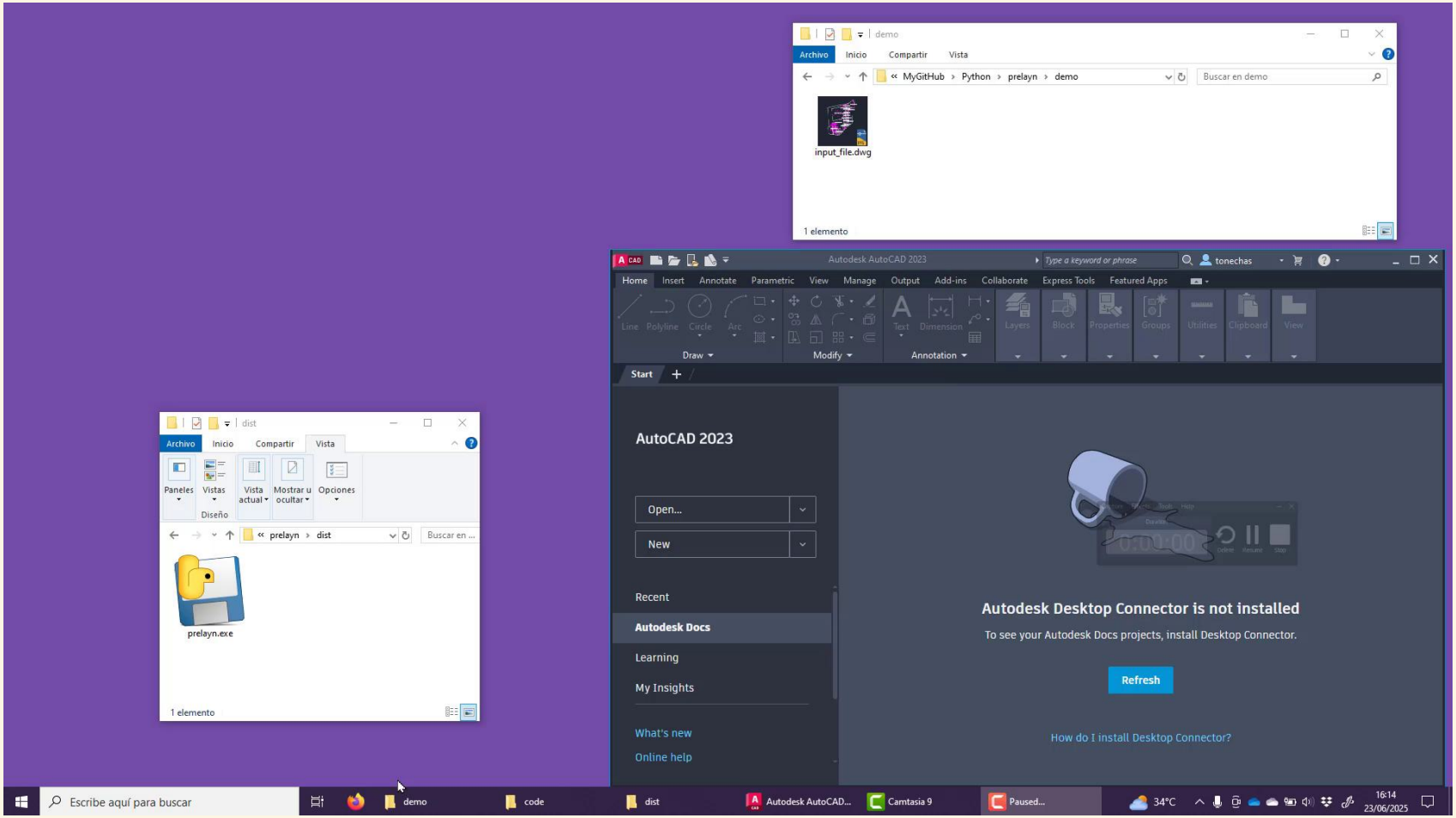
win32com

- Uses the COM interface via `pywin32`
- Full control of the AutoCAD environment
- Requires AutoCAD to be running
- Prone to runtime errors and needs error handling

```
from win32com.client.dynamic import Dispatch

prefix = 'CADASTRE_'
acad = Dispatch('AutoCAD.Application')
acad.Visible = True
doc = acad.Documents.Open('input_file.dwg')
for layer in doc.Layers:
    name = layer.Name
    if name not in ('0', 'Defpoints'):
        layer.Name = prefix + name
doc.SaveAs('output_file.dwg')
```

Automating the task with COM scripting (`win32com`)



pyautocad

- Simplified access to AutoCAD through COM
- Easier to learn than `win32com`
- Limited access to the full COM API
- Not actively maintained

```python
from pyautocad import Autocad

prefix = 'CADASTRE_'
acad = Autocad(create_if_not_exists=True)
for layer in acad.doc.Layers:
    name = layer.Name
    if name not in ('0', 'Defpoints'):
        layer.Name = prefix + name
```

ezdxf

- No need for AutoCAD or Windows
- Easy to use and well documented
- Fast and lightweight
- Works only with DXF files

```
import ezdxf

prefix = 'CADASTRE_'
doc = ezdxf.readfile('input_file.dxf')
clayer_name = doc.header['$CLAYER']
doc.header['$CLAYER'] = '0'
names = [layer.dxf.name for layer in doc.layers]
for name in names:
    if name not in ('0', 'Defpoints'):
        layer = doc.layers.get(name)
        layer.rename(prefix + name)
doc.header['$CLAYER'] = prefix + clayer_name
doc.saveas('output_file.dxf')
```

pyautogui

- Keyboard and mouse simulation
- Works on any platform
- Slow and fragile due to UI dependencies

```
import pyautogui as pgui
import os, time

def typewrite(keyboard_input, delay=1):
    pgui.typewrite(keyboard_input)
    pgui.keyDown('enter')
    pgui.keyUp('enter')
    time.sleep(delay)

prefix = 'CADASTRE_'
names = ['BUSQUEDA', 'CONSTRUCCION', 'PARCELA', 'REFCATASTRAL',
         'SUBPARCELA', 'TXTCONSTRU', 'TXTSUBPA']
os.startfile('start input_file.dwg')
time.sleep(3)
for name in names:
    typewrite('-LAYER')
    typewrite('Rename')
    typewrite(name)
    typewrite(prefix + name)
    pgui.hotkey('escape')
typewrite('SAVEAS')
typewrite('output_file.dwg')
pgui.hotkey('alt', 's')
```

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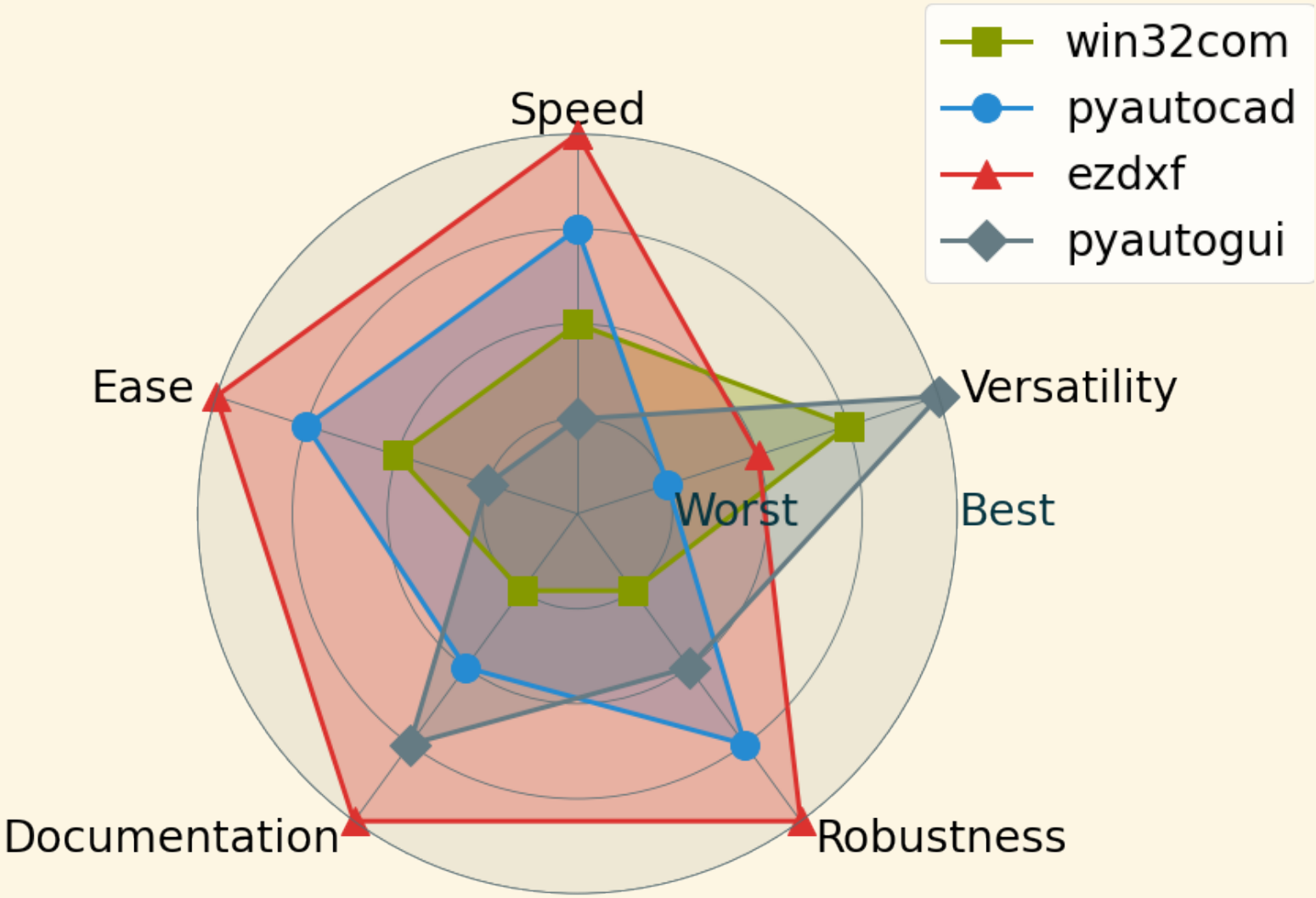
Results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Speed
Versatility
Ease
Worst
Best
Documentation
Robustness

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Main conclusions

- Choice depends on task and user needs
- `pyautocad` is easy but limited
- `win32com` is powerful but error-prone
- `ezdxf` is the most convenient package

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