

# Software Project, Final Presentation

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Gobbles up your **s** mistakes

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# Context

# Theoretical Background

## Grammatical Error

- **Instance of faulty**, unconventional, or controversial usage
- Traditionally identified at **five levels**:
  - Lexical (*\*tipe/type*)
  - Syntactic (*she \*know/knows*)
  - Semantic (*\*big/long conversation*)
  - Discourse (*Mary likes apples. \*He/She wants to eat*)
  - Pragmatic (*A: Do you want water or coffee? B: Yes*)
- GECko+ broadly addresses **morphosyntactic**, **lexico-semantic**, and **typographical** errors, mildly addresses **discourse** errors

# Prior Approaches and State of the Art I

## Grammatical Error Correction

- Rule-based systems
  - Based on **syntactic analysis**
- Machine learning classifiers
  - **Closed-class** errors
- **Machine translation** for GEC
  - SMT
  - NMT

# Prior Approaches and State of the Art II

## Discourse Analysis

- **Local** analysis
  - Coherence, entities, topic, etc.
- **Global** analysis
  - Writing conventions
- Sentence ordering
  - **HMMs**
  - Sequence prediction with **encoder-decoder** framework



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# Implementation



# Models: GECToR I

- Addresses **sentence-wise** errors
- **Sequence tagging** task
  - 5000 custom tags
- **Parallel corpus** (errorful-correct pairs)
- **Preprocessing:**
  - Tags the source sentence, one tag per token

## Corpus

A ten years old boy go school

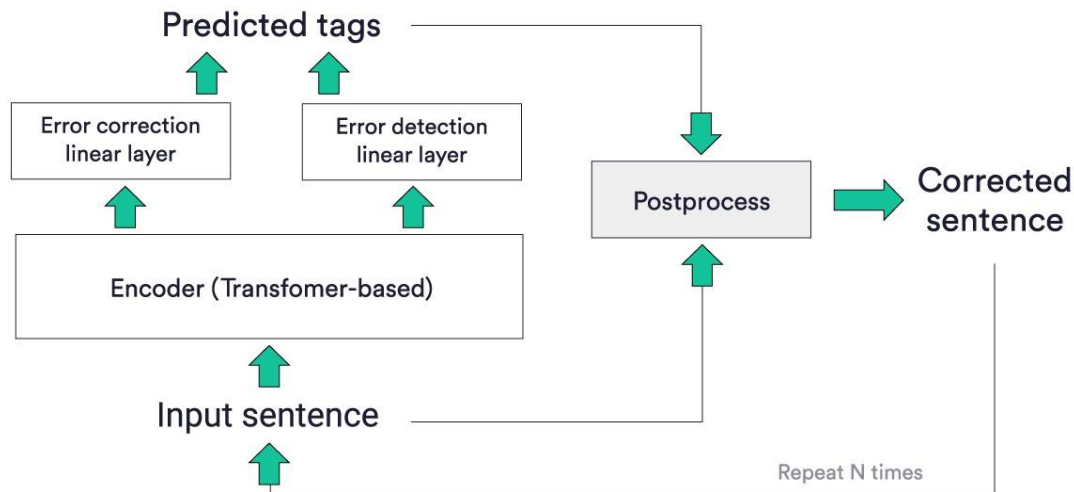
|

A ten-year-old boy goes to school.

A → \$KEEP, ten → \$MERGE\_HYPHEN, years → \$NOUN\_NUMBER\_SINGULAR, old → \$KEEP, boy → \$KEEP, go → \$VERB\_FORM\_VB\_VBZ, school → \$APPEND\_{.}

# Models: GECToR II

- Model:
  - BERT-like **Transformer**, three training steps
- **Iterative correction** approach



# Models: Sentence Ordering

- Tackles **discourse-wise** errors
- **Constraints learning** task
- **Input:** list of possibly unordered sentences
- Fine-tuned **BERT** predicts constraints (= **relative orderings**) between **pairs** of sentences from input list
- **Topological sorting** on the constraints to reorder sentences
- **Output:** correct order of the sentences

---

**S1:** I used to love spending time with my daughter.

**S3:** In the park, we took long walks, talking about anything and everything.

**S2:** We would go to Central Park on Sundays.

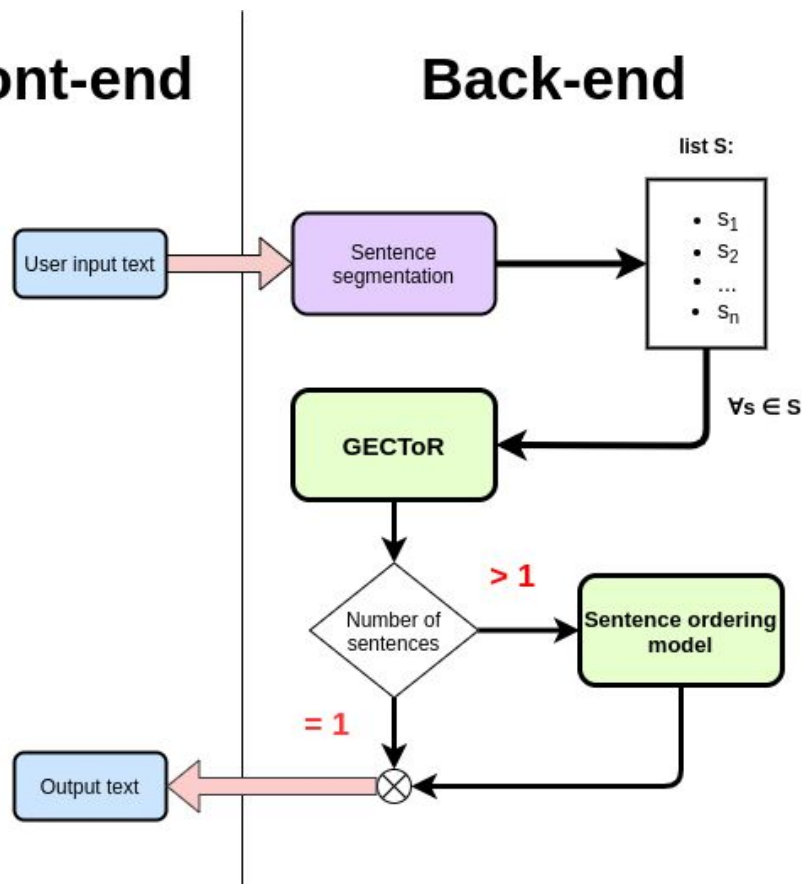
**S4:** I miss these days, watching the dogs running around.

---

# GECKo+'s Pipeline

Front-end

Back-end



# Software Architecture I



## A Flask web-application

- Debug
- *HTML* template rendering
- Easy serving utility

## Languages:

- *Python*: Flask framework, model computations (back-end)
- *HTML*: website structure
- *SCSS*: website layout and style
- *JavaScript*: user interactions (prediction triggering, demo, etc.)

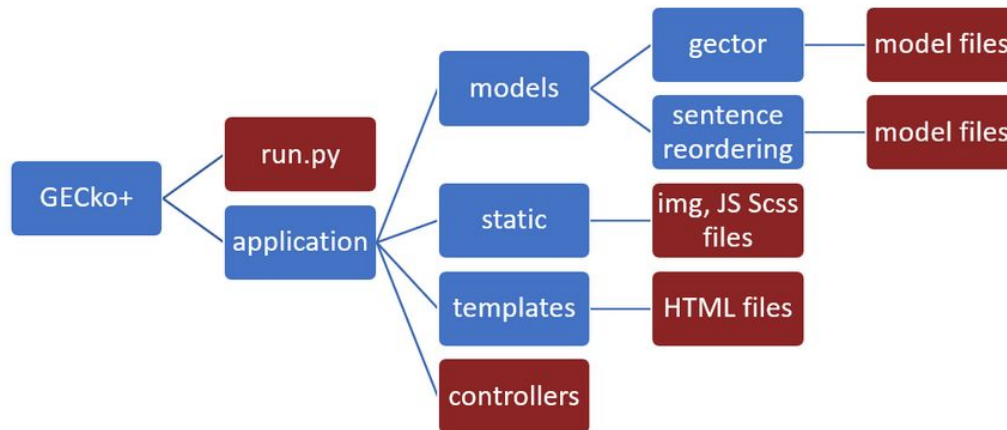
# Software Architecture II

## Files stored

- Python (models, Flask server)
- Website (HTML, JS, SCSS, etc.)
- Images
- Pre-trained models

## Modular structure

- Files grouped in **thematic folders**
- Pipeline executed from root files
- Better **maintenance**, and upgradability



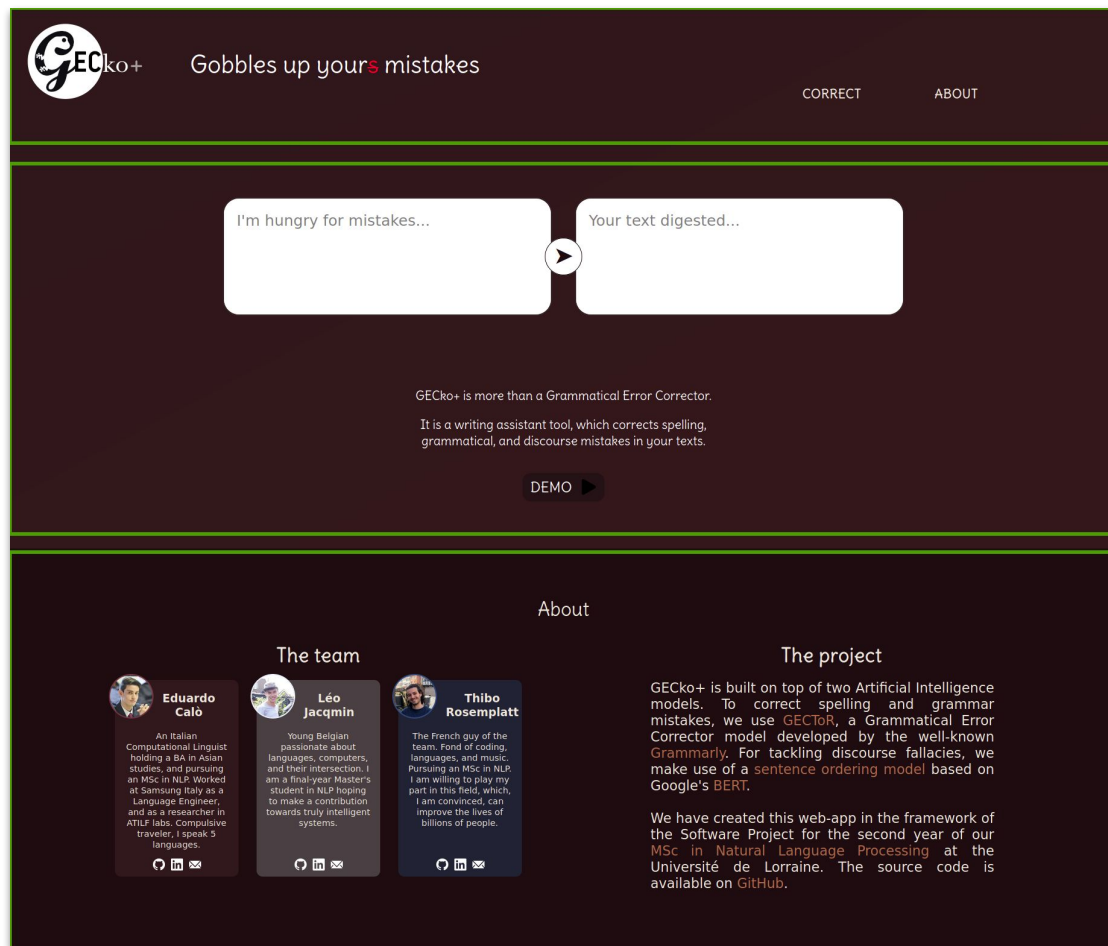
# UX Design - Interface

## Minimalist and accessible

- Single page
- Easy to use
- No distractions
- Focused on the content

## Layout (3 sections):

- Header
- Interactive section
- About section



# UX Design - Responsive Design

## Layout will adapt to various devices

CSS media queries





# UX Design - Visualize Corrections

Intuitive color code:

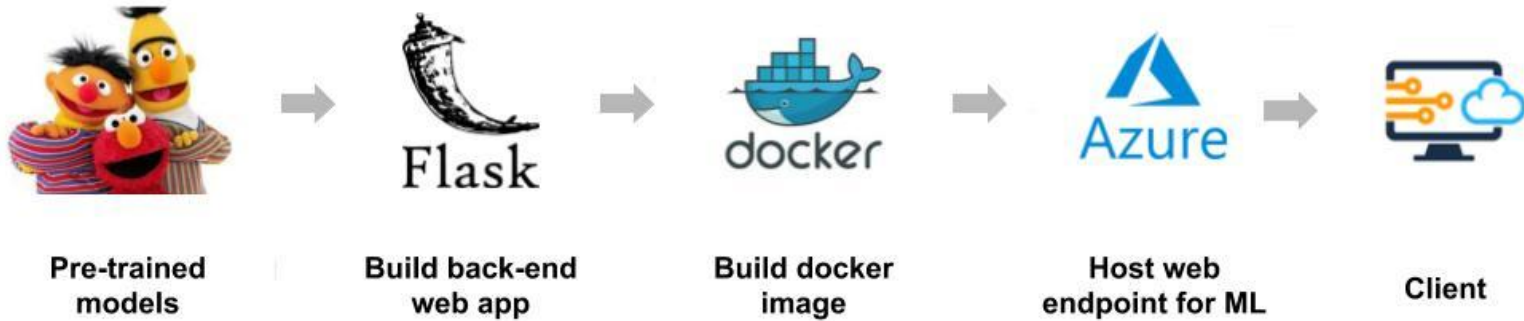
- Replacement
- Addition
- Deletion

Someone which I loved once gave a box full of darkness. It took me a many years to understand that this, too, was a gift



Someone who I loved once gave me a box full of darkness. It took me many years to understand that this, too, was a gift.

# Deployment - Pipeline



# Deployment - Environments I

## Developing

- Debug utility
- SASS compiler ON
- Convenient and light serving utility

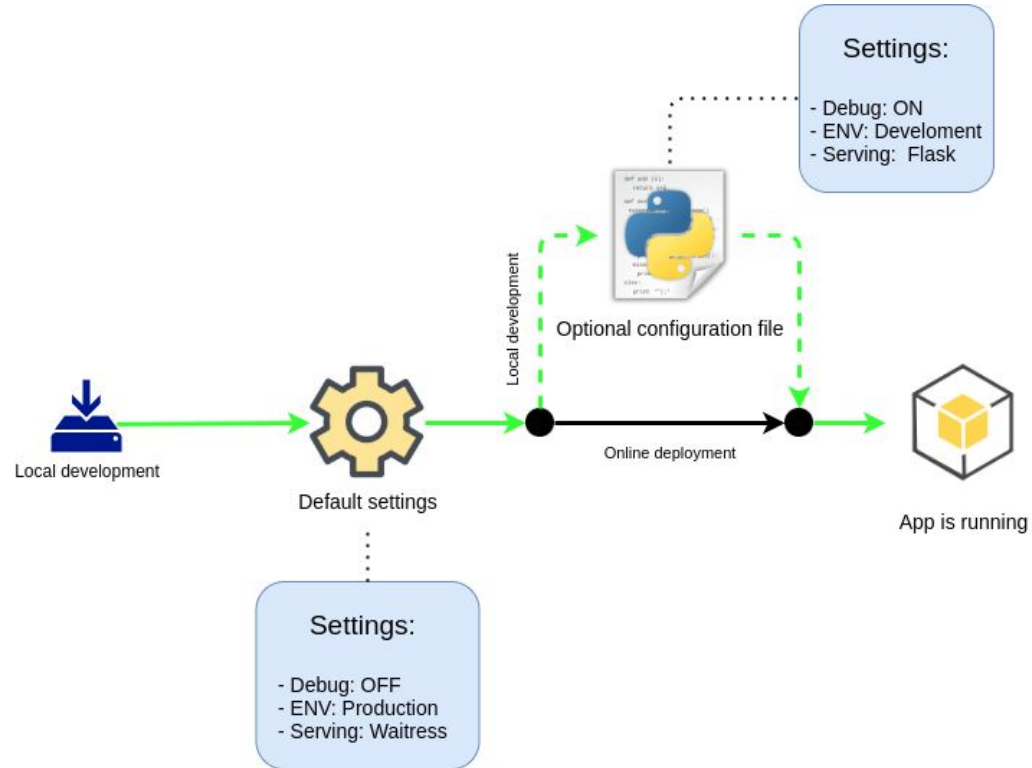
```
* Serving Flask app "myapp" (lazy loading)
* Environment: production
  WARNING: Do not use the development server in a production environment.
  Use a production WSGI server instead.
* Debug mode: off
```

## Deploying

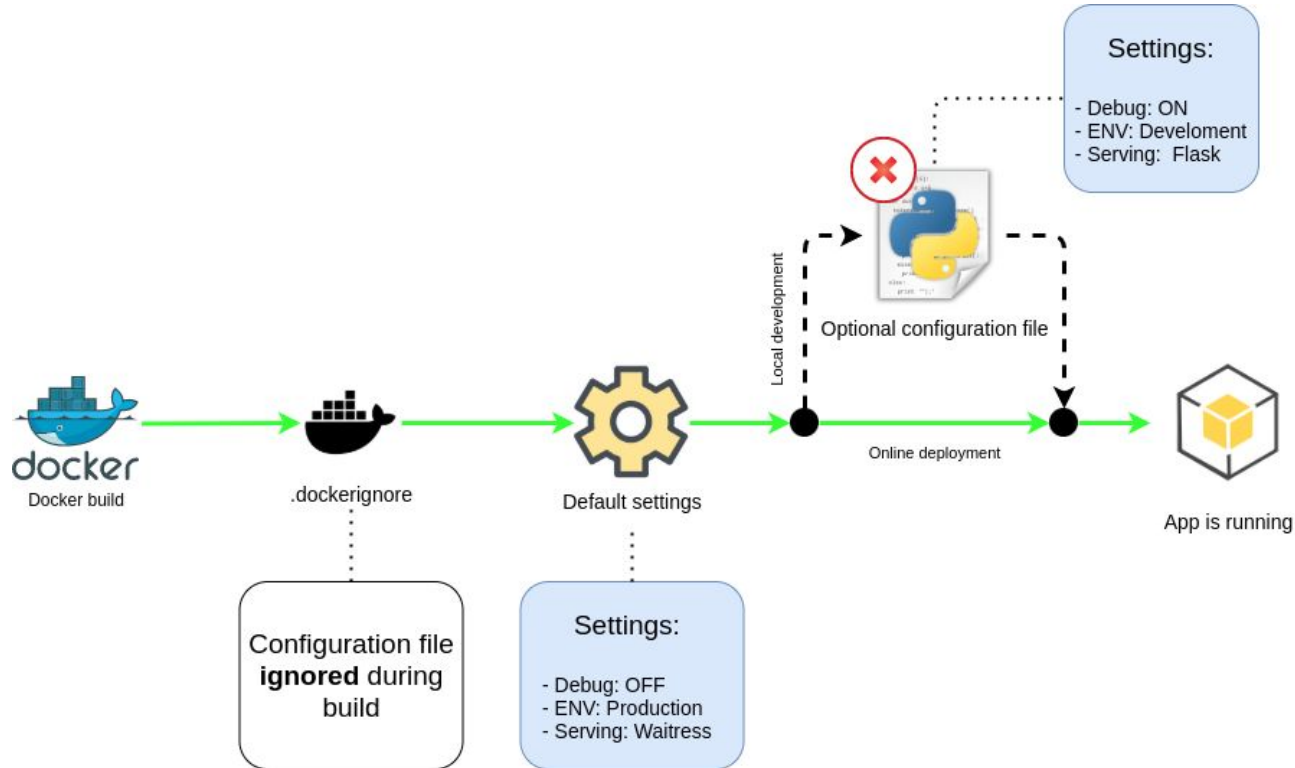
- No debug utility
- SASS compiler OFF
- Solid and heavy serving utility:  
**Waitress** library

Need **two environments**

# Deployment - Environments II



# Deployment - Environments III





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# Use cases

# Some Case Studies

Joe Smith is a old Englishman who lives in London all his life.

---



Joe Smith is an old Englishman who has lived in London all his life.

---

She refuses to listen to them and is running out of the room when they bring up the subject. They advised Mary having an abortion.

---



They advised Mary to have an abortion. She refuses to listen to them and runs out of the room when they bring up the subject.

---

i dont like going there. i consider swimming pool bored

---



I consider swimming pool boring. I don't like going there.

---



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# Conclusion



# Difficulties

- **Pipeline**

Models made for batch training

- **Errors' Highlighting**

Token-level tricky

- **Deployment**

Learning curve with Docker and Azure

- **Discourse Analysis**

Complex task

# Current Status

Yesterday the weather was nice. I don't need to take an umbrella.



Yesterday the weather was nice. I don't need to take an umbrella.

My boss is disrespectful to her employees.



My boss is disrespectful to her employees.

Joe Smith divorced a year ago. His two daughters now lives with his ex-wife. The older girl has recently become pregnant and would like to keeping the baby. Joe think that she is too young for the responsibility of bringing up a child as a single parent.



Joe Smith got divorced a year ago. The older girl has recently become pregnant and would like to keep the baby. Joe thinks that she is too young for the responsibility of bringing up a child as a single parent. His two daughters now live with his ex-wife.

Yesterday the weather was nice. I **didn't** need to take an umbrella.

My boss is **disrespectful** to her employees.

Joe Smith got divorced a year ago. **His two daughters now live with his ex-wife.** The older girl has recently become pregnant and would like to keep the baby. Joe thinks that she is too young for the responsibility of bringing up a child as a single parent.

# Future Work

- **Visualize** sentence **reordering**
- Remove **formatting** in **input text**
- Miscellaneous
  - Additional **languages**
  - **Improve** pre-trained **models**
  - **Personalize** corrections using a glossary



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# Thank you!

Do you had questionss?



Do you have any questions?