



IT Systems Engineering
Universität Potsdam

Captcha Service

Documentation

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Abstract

The increasing numbers of bots, especially crawlers, within the World Wide Web has been a major concern for several years now. Over the years, different approaches to tackle bots were implemented and tested. One of the major solutions for dealing with bots in the recent years were Captchas. Originally, giving users specific tasks to solve, which bots would be unable to solve, was the main idea. Through distortion and other obstacles, Captchas were improved against algorithmic solutions.

The potential of million online users solving Captchas was quickly realized. Difficulties in identifying words or objects in images using computers, could be solved using the combined solutions of Captcha users. We implemented our own Captcha Service in order to allow researchers and scientists to get their own datasets labeled using on-line users.

Contents

1 Introduction

1.1 Motivation

Researchers and scientists are lacking the time and capacities to label their data, which is often further needed in order to advance other technologies. Using required authentication processes for online users, we are able to utilize huge amounts of free labor. Our main goal was building a straightforward service for researchers and scientists to allow precise data labeling.

Therefore, a simple integration for web services was also wanted.

2 Related Work

<http://vision.ucsd.edu/sites/default/files/soylentgrid.pdf>

There are several Captcha types, each one being suitable for labeling different data.

Google's reCaptcha is the major player for text Captchas. While google was analyzing and making digital copies of books, their CRM algorithms were not able to identify every word. Google used reCaptcha to identify these words. The user was asked to identify two words, of which one word was known and used for validation.

Bild von reCaptcha

3 Architecture / Distortion

The architecture is mainly represented in the models.py data. It is designed for simple expandability and uses inheritance to simplify the introduction of new captcha types. An overview is given in the class diagram in figure ??.

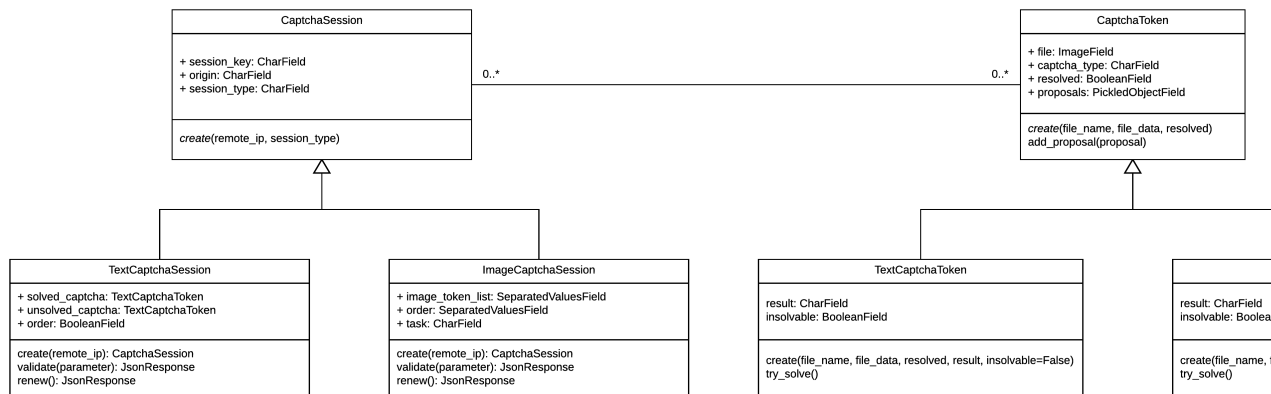


Figure 1: Class diagram representing the classes used for the generation of captchas. TODO text, update

It consists of two main classes, the *CaptchaToken* and *CaptchaSession*. The class *CaptchaToken* represents a single image, that is part for a captcha, e.g. a single word, that needs to be written down by the user in order to solve the captcha. The class *CaptchaSession* represents a complete captcha challenge a user has to solve, e.g. writing down the words shown on all images. Each type of captcha challenge provided by the service is represented by a subclass of *CaptchaSession* and *CaptchaToken*. Currently two kinds of Captchas, ImageCaptchas and TextCaptchas are supported.

All that needs to be done for implementing a new type of captcha challenge is to create a new subclass for *CaptchaToken* and *CaptchaSession* and implement specific functionality in these subclasses. Which methods and attributes need to be added in the new subclasses is listed in the “Attributes and Methods implemented in the subclass” paragraph.

All instances of a *CaptchaToken* or *CaptchaSession* are saved in the `db.sqlite3`-

Database.

3.1 CaptchaToken

TODO konsistenz kuze beschr u einleitung The class *CaptchaToken* represents a single image, that is part for a captcha, e.g. a single word, that needs to be written down by the user in order to solve the captcha.

Attributes and Methods implemented in the superclass

Attributes:

- `file`: Image, that is represented by the *CaptchaToken*.
- `captcha_type`: String, that defines the type of captcha the token can be used for. Currently "text" for Textcaptchas and "image" for Imagecaptchas are supported.
- `resolved`: Boolean, that indicates, if the solution for a *CaptchaToken* is known or not. A 0 means the token is unsolved and a 1 means the Token is solved.
- `proposals`: Dictionary, that stores the possible solutions suggested by users of the captcha service and how often each solution was suggested.
- `insolvable`: Boolean that indicates, that a token is not solvable by clients of the captcha service.

Methods:

- `create(file_name, file_data, resolved)`: Responsible for basic configuration, that need to be done for all kinds of tokens, when they are created. Only used for supercalls in the `create()`-method of subclasses.
- `add_proposals(proposal)`: Adds a new suggested solution to the proposals-dictionary, or increments the counter for an already suggested proposal.

Attributes and Methods implemented in the subclass

Attributes:

- `result`: Saves the correct solution for a token. Datatype differs between different subclasses, e.g. *TextCaptchaToken* saves a string and *ImageCaptchaToken* saves a boolean.

Methods:

- `create(file_name, file_data, resolved, result, insolvable=False)`: Responsible for configuring all attributes of the *CaptchaToken*. Returns a *CaptchaToken*.
- `try_solve`: Responsible for finding the correct solution for a *CaptchaToken* based on the values saved in the `proposals`-attribute.

3.2 CaptchaSession

TODO konsistenz kuze beschr u einleitung Represents an instance of a captcha challenge, that needs to be solved by a certain client. A *CaptchaSession* consists of multiple *ImageTokens*, that are chosen randomly in order to create different challenges dynamically. Each Sessions corresponds to one of the supported types of *CaptchaTokens*.

Attributes and Methods implemented in the superclass

Attributes:

- `session_key`: String, that serves as primary key to identify each session.
- `origin`: String, that holds the IP adress that requested the captcha challenge. It is used match requests made by the client to the corresponding session.
- `session_type`: String, that defines the kind of captcha challenge, the

client has to solve. Currently “text” for Textcaptchas and “image” for Imagecaptchas are supported.

Methods:

- `create(remote_ip, session_type)`: Responsible for basic creation of a *CaptchaSession* of the requested type for the given IP adress. Only used for supercalls in the `create()`-method of subclasses.

Attributes and Methods implemented in the subclass

Attributes:

Each session needs to store the tokens, that were used for creating the session and additional information, that is needed for validating the answer given by the client. This can differ for every captchatype.

TextCaptchaSession:

- `solved_captcha_token`: *TextCaptchaToken*, that is already solved and is used as a control word for the session.
- `unsolved_captcha_token`: *TextCaptchaToken*, that is not solved and shall be solved by the client.
- `order`: Boolean indicating the order, in which the two tokens are displayed to the client. (0 -> solved unsolved 1 -> unsolved solved) It is needed to map the answers given by the client to the right tokens.

ImageCaptchaSession:

- `image_token_list`: List of *ImageCaptchaTokens*, where all tokens used for the session are saved.
- `order`: List of Booleans, that indicates which token in the `image_token_list` is solved. (0 -> unsolved, 1 -> solved)
- `task`: String, that saves the task for the *ImageCaptchaSession*, e.g. which objects should be detected in the images.

Methods:

- `create(remote_ip)`: Responsible for creating a *CaptchaSession* and returning the created session to the corresponding *view*.
- `validate(parameters)`: Responsible for validating the solution for a *CaptchaSession* and returning the created session to the corresponding *view*. The solution suggested by the client is included in the parameters. Returns whether the session is valid or not.
- `renew()`: Responsible for exchanging the *CaptchaTokens* of a *CaptchaSession*, to create a new challenge or the same session.

4 Implementation

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5 Evaluation

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6 Future Work

With the thought in mind of building an easy expandable service, the logic consequence would be on focussing on different Captcha types. In the process, key factors such as access for disabled users can be tackled, e.g. by implementing audio Captchas. Another aspect would be expanding the Webinterface. The option of downloading solved and unsolved Captchas can be specialized by selectin specific upload times or certain time spans. A feedback of the labeling progress within a task would also be another great tool.

A Appendix

Appendix