ml_dev - Machine Learning Development Image

This image supports the use of a Docker container for the development of Machine Learning projects in an Ubuntu environment.

Table of Contents

1. Installed core components

With the following command you can check in detail which software versions are included in the Docker image:

```
apt list --installed
```

Version 1.1.0

Component	Version	Remark	Status
Anaconda			removed
asdf	v0.8.1-a1ef92a		new
cURL	7.77.0		new
Docker Compose	1.29.2		upgrade
Docker Engine	20.10.7		upgrade
dos2unix	7.4.2		new
Eclipse	2021-06-R		upgrade
GCC & G++	10.3.0		new
Git	2.32.0		upgrade
Gradle	7.1.1		upgrade
htop	3.0.5		new
ImageMagick	7.1.0-2		upgrade
Java	16.0.1	openjdk	upgrade
Julia	1.6.1		new

Component	Version	Remark	Status
Python	3.9.6		upgrade
- alpha_vantage	2.3.1		upgrade
- fbprophet			removed
- fire	0.4.0		upgrade
- Keras	2.4.3		
- matplotlib	3.4.2		upgrade
- numpy	1.19.5		upgrade
- pandas	1.3.0		upgrade
- pip	21.1.3		upgrade
- prophet	1.0.1		new
- pystan	3.2.0		new
- PyYAML	5.4.1		upgrade
- requests	2.25.1		upgrade
- scikit-learn	0.24.2		upgrade
- scipy	1.7.0		upgrade
- seaborn	0.11.1		upgrade
- statsmodels	0.12.2		upgrade
- tensorflow	2.5.0		upgrade
- Theano	1.0.5		
R	4.1.0		upgrade
- caret	6.0.88		upgrade
- knitr	1.33		upgrade
- rmarkdown	2.9		upgrade
- tidymodels	0.1.3		upgrade
- rsample	0.1.0		upgrade
- parsnip	0.1.6		upgrade
- recipes	0.1.16		upgrade
- workflows	0.2.2		upgrade
- tune	0.1.5		upgrade
- yardstick	0.0.8		upgrade

Component	Version	Remark	Status
- broom	0.7.8		upgrade
- dials	0.0.9		
- tidyverse			
- ggplot2	3.3.5		upgrade
- dplyr	1.0.7		upgrade
- tidyr	1.1.3		upgrade
- readr	1.4.0		
- purrr	0.3.4		
- tibble	3.1.2		upgrade
- stringr	1.4.0		
- forcats	0.5.1		upgrade
RStudio	1.4.1717	for virtual machine only	upgrade
Ubuntu	20.04.2 LTS	focal	upgrade
Vim	8.2.3083		upgrade
wget	1.21.1		

Version 1.0.4

Component	Version	Remark	Status
Anaconda	1.7.2	2020.07	
Docker Compose	1.27.4		
Docker Engine	19.03.13		
Eclipse	2020-09	for virtual machine only	
Git	2.29.2		upgrade
Gradle	6.7		
ImageMagick	7.0.10-37		upgrade
Java (openjdk)	15	build 15+36-1562	
Python	3.8.3		
- pip	20.2.4		
- alpha_vantage	2.2.0		
- fbprophet	0.7.1		new

Component	Version	Remark	Status
- fire	0.3.1		new
- Keras	2.4.3		upgrade
- matplotlib	3.3.3		new
- numpy	1.19.4		new
- pandas	1.1.4		new
- PyYAML	5.3.1		new
- requests	n/a		new
- scikit-learn	0.23.2		upgrade
- scipy	1.5.4		upgrade
- seaborn	0.11.0		
- statsmodels	0.12.1		upgrade
- tensorflow	2.3.1		
- Theano	1.0.5		upgrade
R	4.0.3		
- caret	6.0.86		
- knitr	1.30		
- rmarkdown	2.5		
- tidymodels	0.1.1		
- rsample	0.0.8		
- parsnip	0.1.4		
- recipes	0.1.15		upgrade
- workflows	0.2.1		
- tune	0.1.1		
- yardstick	0.0.7		
- broom	0.7.2		
- dials	0.0.9		
- tidyverse			
- ggplot2	3.3.2		
- dplyr	1.0.2		
- tidyr	1.1.2		

Component	Version	Remark	Status
- readr	1.4.0		
- purrr	0.3.4		
- tibble	3.0.4		
- stringr	1.4.0		
- forcats	0.5.0		
RStudio	1.3.1093	for virtual machine only	
Ubuntu	20.04.1 LTS	focal	
Vim	8.1		

Version 1.0.3

Component	Version	Remark	Status
Anaconda	1.7.2	2020.07	
Docker Compose	1.27.4		
Docker Engine	19.03.13		
Eclipse	2020-09	for virtual machine only	
Git	2.29.0		
Gradle	6.7		
ImageMagick	7.0.10-34		
Java (openjdk)	15	build 15+36-1562	
Python	3.8.3		
- alpha_vantage	2.2.0		
- keras	2.4.0		new
- pip	20.2.4		
- scikit-learn	0.23		new
- scipy	1.5.3		new
- seaborn	0.11.0		new
- statsmodels	0.12.0		new
- tensorflow	2.3.1		new
- theano	1.0.0		new
R	4.0.3		

Component	Version	Remark	Status
- caret	6.0.86		
- knitr	1.30		
- rmarkdown	2.5		
- tidymodels	0.1.1		
- rsample	0.0.8		
- parsnip	0.1.4		
- recipes	0.1.14		
- workflows	0.2.1		
- tune	0.1.1		
- yardstick	0.0.7		
- broom	0.7.2		
- dials	0.0.9		
- tidyverse			
- ggplot2	3.3.2		
- dplyr	1.0.2		
- tidyr	1.1.2		
- readr	1.4.0		
- purrr	0.3.4		
- tibble	3.0.4		
- stringr	1.4.0		
- forcats	0.5.0		
RStudio	1.3.1093	for virtual machine only	
Ubuntu	20.04.1 LTS	focal	
Vim	8.1		

Version 1.0.2

Component	Version	Remark	Status
Anaconda	1.7.2	2020.07	
Docker Compose	1.27.4		
Docker Engine	19.03.13		

Component	Version	Remark	Status
Eclipse	2020-09	for virtual machine only	
Git	2.29.0		
Gradle	6.7		
ImageMagick	7.0.10-34		
Java (openjdk)	15	build 15+36-1562	
Python	3.8.3		
- alpha_vantage	2.2.0		new
- matplotlib	3.3.2		new
- pandas	1.1.3		new
R	4.0.3		
- caret	6.0.86		new
- knitr	1.30		new
- rmarkdown	2.5		new
- tidymodels	0.1.1		new
- rsample	0.0.8		new
- parsnip	0.1.4		new
- recipes	0.1.14		new
- workflows	0.2.1		new
- tune	0.1.1		new
- yardstick	0.0.7		new
- broom	0.7.2		new
- dials	0.0.9		new
- tidyverse			new
- ggplot2	3.3.2		new
- dplyr	1.0.2		new
- tidyr	1.1.2		new
- readr	1.4.0		new
- purrr	0.3.4		new
- tibble	3.0.4		new
- stringr	1.4.0		new

Component	Version	Remark	Status
- forcats	0.5.0		new
RStudio	1.3.1093	for virtual machine only	
Ubuntu	20.04.1 LTS	focal	
Vim	8.1		

Version 1.0.1

Component	Version	Remark	Status
Anaconda	1.7.2	2020.07	
Docker Compose	1.27.4		upgrade
Docker Engine	19.03.13		
Eclipse	2020-09	for virtual machine only	
Git	2.29.0		upgrade
Gradle	6.7		upgrade
ImageMagick	7.0.10-34		new
Java (openjdk)	15	build 15+36-1562	
Python	3.8.3		
R	4.0.3		
RStudio	1.3.1093	for virtual machine only	
Ubuntu	20.04.1 LTS	focal	upgrade
Vim	8.1		

Version 1.0.0

Component	Version	Remark	Status
Anaconda	1.7.2	2020.07	
Docker	19.03.13		
Docker Compose	1.27.1		
Eclipse	2020-09	for virtual machine only	
Git	2.28.0		
Gradle	6.6.1		
Java (openjdk)	15	build 15+36-1562	

Component	Version	Remark	Status
Python	3.8.3		
R	4.0.3		
RStudio	1.3.1093	for virtual machine only	
Ubuntu	20.04	focal	
Vim	8.1		

2. Creating a new Machine Learning development container

2.1 Getting started

```
> REM Assumptions:
> REM   - the name of the Docker container should be: my_ml_dev
> REM   - the path the host repository is: //C/projects/my_repro
> REM   - the directory name for this repository inside the container should be: my_repro_dir
> REM   - you want to use the latest version of the Konnexions development image
> docker run --name my_ml_dev \
             -v //C/projects/my_repro:/my_repro_dir \
             konnexionsgmbh/ml_dev:latest

> REM Stopping the container
> docker stop my_ml_dev

> REM Restarting the container
> docker start my_ml_dev

> REM Entering a running container
> docker exec -it my_ml_dev bash
```

2.2 Detailed Syntax

A new container can be created with the `docker run` command.

Syntax:

```
docker run -it
           [--name <container_name>] \
           konnexionsgmbh/ml_dev[:<version>]
           [<cmd>]
```

Parameters:

- **container_name** - an optional container identification
- **directory_repository** - an optional host repository directory - the default value is expecting the repository inside the container
- **version** - an optional version number of the image or the constant `latest`
- **cmd** - an optional command to be executed in the container, default is `bash` for running the `bash` shell

Detailed documentation for the command `docker run` can be found here.

Examples:

1. Creating a new Docker container named `my_ml_dev` using a repository inside the Docker container:

   ```
   docker run -it --name my_ml_dev konnexionsgmbh/ml_dev:latest
   ```

2. Creating a new Docker container named `my_ml_dev` using the host repository of a Windows directory `D:\projects\my_repro`:

   ```
   docker run -it --name my_ml_dev -v //D/projects/my_repro:/my_repro konnexionsgmbh/ml_dev:latest
   ```

3. Creating a new Docker container named `my_ml_dev` using the host repository of a Linux directory `/my_repro`:

   ```
   docker run -it --name my_ml_dev -v /my_repro:/my_repro konnexionsgmbh/ml_dev:latest
   ```

3. Working with an existing Machine Learning development container

3.1 Starting a stopped container

A previously stopped container can be started with the `docker start` command.

Syntax:

```
docker start <container_name>
```

Parameter:

- **container_name** - the mandatory container identification, that is an UUID long identifier, an UUID short identifier or a previously given name

Detailed documentation for the command `docker start` can be found here.

3.2 Entering a running container

A running container can be entered with the `docker exec` command.

Syntax:

```
docker exec -it <container_name> <cmd>
```

Parameter:

- **container_name** - the mandatory container identification, that is an UUID long identifier, an UUID short identifier or a previously given name
- **cmd** - the command to be executed in the container, e.g. `bash` for running the `bash` shell

Detailed documentation for the command `docker exec` can be found here.

4. Best practices

4.1 Use of a root repository directory on the host computer

If all relevant repositories are located within a common parent directory, then development work in all these repositories can be done within a single Konnexions development container.

Example:

In the following example we assume that the host directory is named `C:\Temp\my_projects` and should be mapped to the `projects` directory in the container.

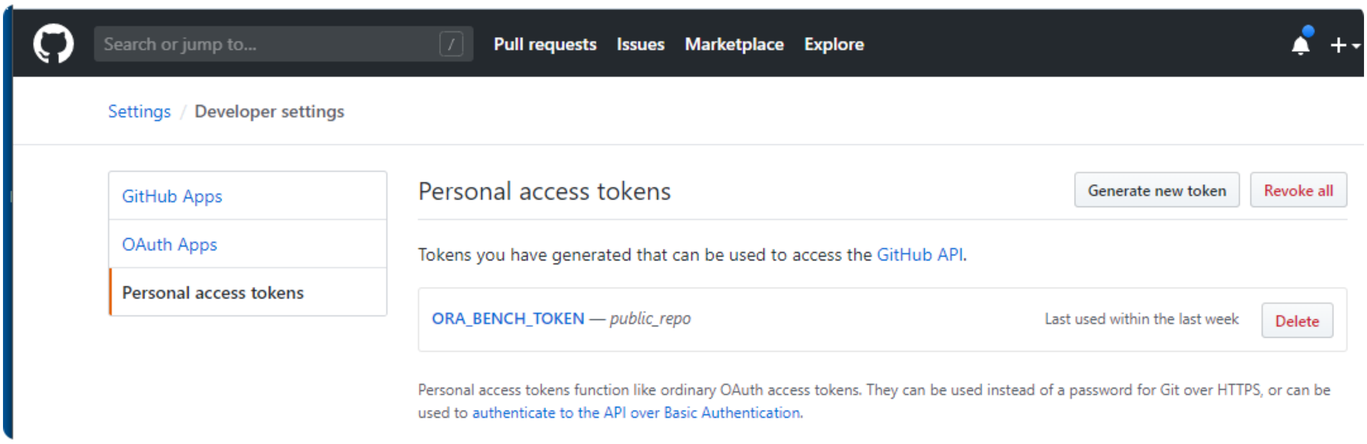
```
>C:\Temp\my_projects>docker run -it --name ml_dev -v
//C/Temp/my_projects:/projects konnexionsgmbh/ml_dev:latest
root@35b9310932f1:/# cd projects
root@35b9310932f1:/projects# ls -ll
total 0
```

4.2 Use of private GitHub repositories inside the container

To access private repositories in GitHub, you must first create a new personal access token in GitHub and then add it to your git configuration inside the container.

1. Create a new personal access token in GitHub

- With the following URL you can create the access token: https://github.com/settings/tokens



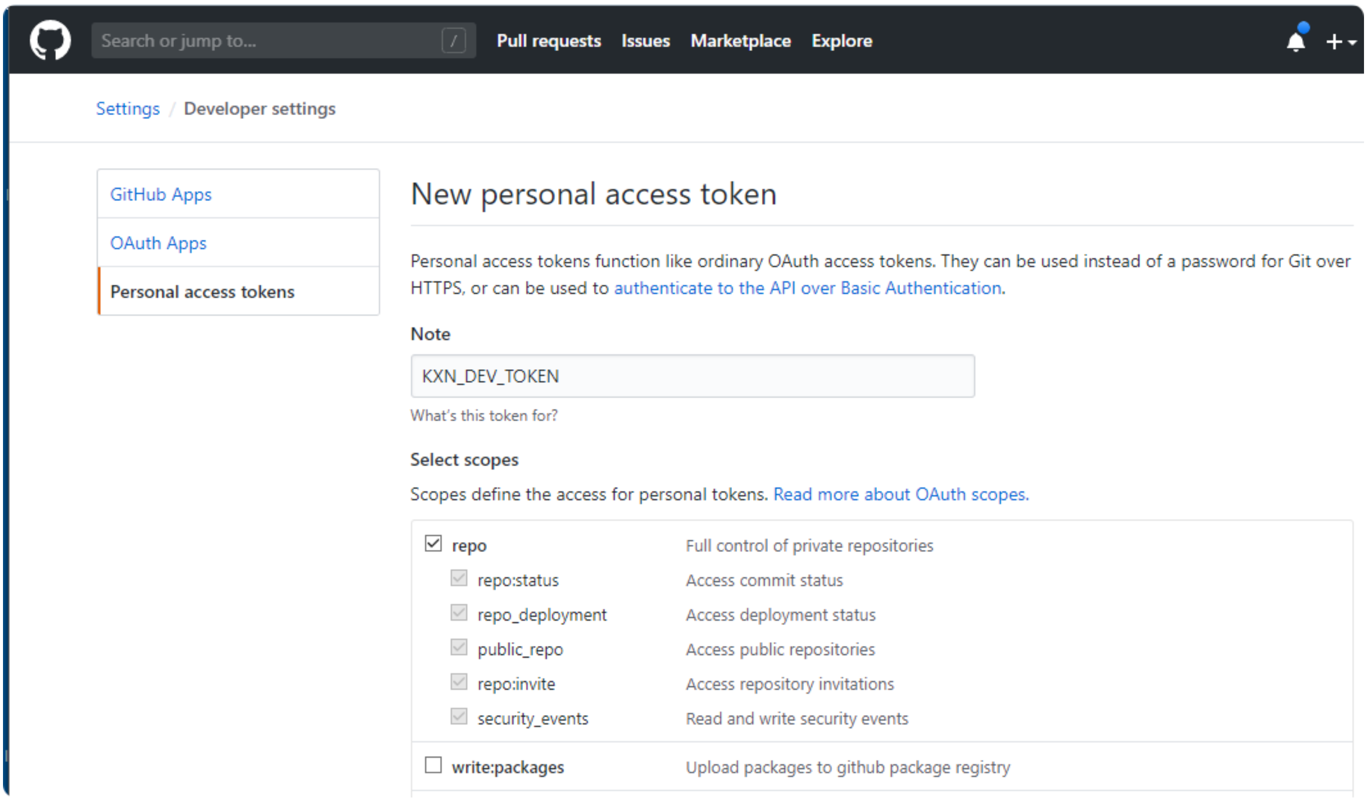
Personal access tokens

Tokens you have generated that can be used to access the GitHub API.

ORA_BENCH_TOKEN — *public_repo* Last used within the last week

Personal access tokens function like ordinary OAuth access tokens. They can be used instead of a password for Git over HTTPS, or can be used to authenticate to the API over Basic Authentication.

- Press the button `Generate new token`



New personal access token

Personal access tokens function like ordinary OAuth access tokens. They can be used instead of a password for Git over HTTPS, or can be used to authenticate to the API over Basic Authentication.

Note

KXN_DEV_TOKEN

What's this token for?

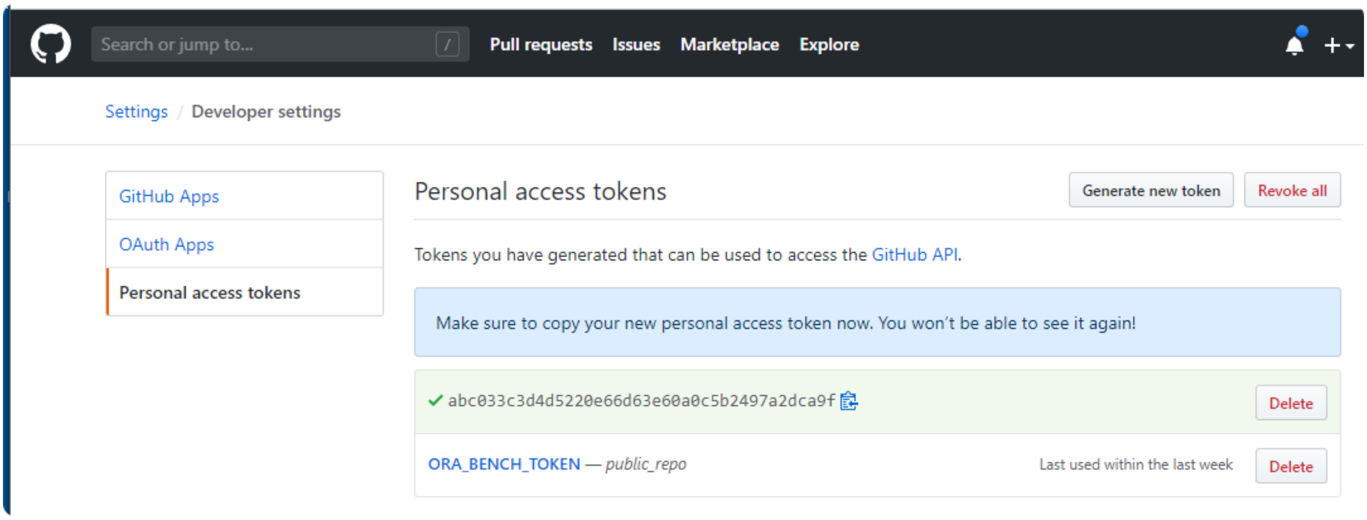
Select scopes

Scopes define the access for personal tokens. Read more about OAuth scopes.

☑ repo Full control of private repositories
- ☑ repo:status Access commit status
- ☑ repo_deployment Access deployment status
- ☑ public_repo Access public repositories
- ☑ repo:invite Access repository invitations
- ☑ security_events Read and write security events

□ write:packages Upload packages to github package registry

- Name the new token, select the scopes and press the button `Generate token`



Personal access tokens

Tokens you have generated that can be used to access the GitHub API.

Make sure to copy your new personal access token now. You won't be able to see it again!

✓ abc033c3d4d5220e66d63e60a0c5b2497a2dca9f

ORA_BENCH_TOKEN — *public_repo* Last used within the last week

- Write down the secret code and keep it in a safe place

2. Setting up the Docker container on the host machine

In the following example we assume that the host directory is named `C:\Temp\my_projects` and should be mapped to the `projects` directory in the container.

```
C:\Temp\my_projects>docker run -it --name ml_dev -v //C/Temp/my_projects:/projects konnexionsgmbh/ml_dev:latest
Unable to find image 'konnexionsgmbh/ml_dev:latest' locally
latest: Pulling from konnexionsgmbh/ml_dev
d51af753c3d3: Pull complete
...
a6bb30d1a5cf: Pull complete
Digest: sha256:5f6d6afc566ef9142d2d85b85dd331c0558eafaaf286179fd0ae787988c1b89b
Status: Downloaded newer image for konnexionsgmbh/ml_dev:latest
```

3. Initial configuration of git in the container

```
root@332206c300f1:/# export XDG_CONFIG_HOME=/projects
root@332206c300f1:/# mkdir -p $XDG_CONFIG_HOME/git/
root@332206c300f1:/# touch $XDG_CONFIG_HOME/git/config
root@332206c300f1:/# touch $XDG_CONFIG_HOME/git/credentials
root@332206c300f1:/# git config --file=$XDG_CONFIG_HOME/git/config credential.helper 'store --file=/projects/git/credentials'
root@332206c300f1:/# git config --file=$XDG_CONFIG_HOME/git/config user.name "John Doe"
root@332206c300f1:/# git config --file=$XDG_CONFIG_HOME/git/config user.email "john.doe@company.com"
root@332206c300f1:/# git config --list --show-origin
file:/projects/git/config       credential.helper=store --file=/projects/git/credentials
file:/projects/git/config       user.name=John Doe
file:/projects/git/config       user.email=john.doe@company.com
```

4. Verification of the settings

```
root@332206c300f1:/# cat /projects/git/config
[credential]
        helper = store --file=/projects/git/credentials
[user]
        name = John Doe
[user]
        email = john.doe@company.com
```

5. Clone a repository for the first time

When prompted provide your github user name and the new personal access token from (1).

```
root@332206c300f1:/# cd projects
root@332206c300f1:~# git clone https://github.com/KonnexionsGmbH/docker_images
Cloning into 'docker_images'...
Username for 'https://github.com': John Doe
Password for 'https://john.doe@company.com':
abc033c3d4d5220e66d63e60a0c5b2497a2dca9f
remote: Enumerating objects: 78, done.
remote: Counting objects: 100% (78/78), done.
remote: Compressing objects: 100% (49/49), done.
remote: Total 78 (delta 33), reused 68 (delta 23), pack-reused 0
Receiving objects: 100% (78/78), 167.83 KiB | 867.00 KiB/s, done.
Resolving deltas: 100% (33/33), done.
```

6. Verify if the clone completed with success

```
root@332206c300f1:~# cat /projects/git/credentials
https://John Doe:abc033c3d4d5220e66d63e60a0c5b2497a2dca9f@github.com
```

7. Verification after a restart of the Docker container

```
C:\Temp\my_projects>docker start ml_dev
ml_dev
C:\Temp\my_projects>docker exec -it ml_dev bash
root@332206c300f1:/# export XDG_CONFIG_HOME=/projects
root@332206c300f1:/# git config --list --show-origin
file:/projects/git/config       credential.helper=store --
file=/projects/git/credentials
file:/projects/git/config       user.name=John Doe
file:/projects/git/config       user.email=john.doe@company.com
```

8. Verification after the removal of the Docker container

- Deleting the Docker container and image

```
C:\Temp\my_projects>docker stop ml_dev
ml_dev

C:\Temp\my_projects>docker rm ml_dev
ml_dev

C:\Temp\my_projects>docker images
REPOSITORY                  TAG                 IMAGE ID            CREATED
SIZE
```

```
konnexionsgmbh/ml_dev      latest              51757b5e414e        6 hours ago
3.71GB

C:\Temp\my_projects>docker rmi 51757b5e414e
Untagged: konnexionsgmbh/ml_dev:latest
Untagged:
konnexionsgmbh/ml_dev@sha256:5f6d6afc566ef9142d2d85b85dd331c0558eafaaf286179fd0ae7
87988c1b89b
Deleted: sha256:51757b5e414e5333ace7b163484c06e4685c29312ad09d5d7d648c6936011a60
...
Deleted: sha256:7789f1a3d4e9258fbe5469a8d657deb6aba168d86967063e9b80ac3e1154333f
```

- Recreating the Docker container (and image)

```
C:\Temp\my_projects>docker run -it --name ml_dev -v //C/Temp/my_projects:/projects
konnexionsgmbh/ml_dev:latest
Unable to find image 'konnexionsgmbh/ml_dev:latest' locally
latest: Pulling from konnexionsgmbh/ml_dev
d51af753c3d3: Pull complete
...
a6bb30d1a5cf: Pull complete
Digest: sha256:5f6d6afc566ef9142d2d85b85dd331c0558eafaaf286179fd0ae787988c1b89b
Status: Downloaded newer image for konnexionsgmbh/ml_dev:latest
root@ad1f036bbc44:/# export XDG_CONFIG_HOME=/projects
root@ad1f036bbc44:/# git clone https://github.com/KonnexionsGmbH/docker_images
Cloning into 'docker_images'...
remote: Enumerating objects: 78, done.
remote: Counting objects: 100% (78/78), done.
remote: Compressing objects: 100% (49/49), done.
remote: Total 78 (delta 33), reused 68 (delta 23), pack-reused 0
Receiving objects: 100% (78/78), 167.83 KiB | 895.00 KiB/s, done.
Resolving deltas: 100% (33/33), done.
```

- If we use the same path - where `git/config` and `git/credentials` exist - as in Step 4, `git` access (clone/push/pull) doesn't ask for username/password anymore.