

Using a Cartesian Vector Class

Copyright (c) 2019 Tor Olav Kristensen, <http://subcube.com> (<http://subcube.com>)

<https://github.com/t-o-k/scikit-vectors> (<https://github.com/t-o-k/scikit-vectors>)

Use of this source code is governed by a BSD-license that can be found in the LICENSE file.

```
In [1]: 1 from skvectors import create_class_Cartesian_Vector
```

```
In [2]: 1 # Create a 4-dimensional cartesian vector class
2
3 CVC = create_class_Cartesian_Vector('CVC', 'ABCD')
4
5 # Explicit alternative:
6 # CVC = \
7 #     create_class_Cartesian_Vector(
8 #         name = 'CVC',
9 #         component_names = [ 'A', 'B', 'C', 'D' ],
10 #         brackets = [ '<', '>' ],
11 #         sep = ', ',
12 #         cnull = 0,
13 #         cunit = 1,
14 #         functions = None
15 #     )
```

```
In [3]: 1 # Check if a vector is the zero vector (i.e. its length is equal to cnull)
2 u = CVC(0, 0, 0, 0)
3 u.is_zero_vector()
```

Out[3]: True

```
In [4]: 1 # Check if a vector is the zero vector
2 u = CVC(0, 0, 1, 0)
3 u.is_zero_vector()
```

Out[4]: False

```
In [5]: 1 # Check if a vector is a unit vector (i.e. its length is equal to cunit)
        2 u = CVC(0.6, 0.0, -0.8, 0.0)
        3 u.is_unit_vector()
```

Out[5]: True

```
In [6]: 1 # Check if a vector is a unit vector
        2 u = CVC(-0.1, 0.5, 0.0, 0.8)
        3 u.is_unit_vector()
```

Out[6]: False

```
In [7]: 1 # Check if a vector is equal to another
        2 u = CVC(-3, -1, 4, 2)
        3 v = CVC(-3, 1, 4, 2)
        4 u == v
```

Out[7]: False

```
In [8]: 1 # Check if a vector is not equal to another
        2 u = CVC(-3, -1, 4, 2)
        3 v = CVC(-3, 1, 4, 2)
        4 u != v
```

Out[8]: True

```
In [9]: 1 # Check if a vector is orthogonal to another
        2 u = CVC(3, 2, -1, 4)
        3 v = CVC(0, 3, 6, 0)
        4 u.are_orthogonal(v)
```

Out[9]: True

```
In [10]: 1 # Check if a vector is orthogonal to another
        2 u = CVC(3, 2, -1, 4)
        3 v = CVC(0, 3, 6, 4)
        4 u.are_orthogonal(v)
```

Out[10]: False

```
In [11]: 1 # Check if a vector is orthogonal to another
        2 # NB: All vectors are orthogonal to the zero vector
        3 u = CVC(3, 2, -1, 4)
        4 v = CVC(0, 0, 0, 0)
        5 u.are_orthogonal(v)
```

Out[11]: True

```
In [12]: 1 # Check if the length of a vector is equal to the length of another
        2 u = CVC(-4, -2, 4, 1)
        3 v = CVC(5, 1, 1, -3)
        4 u.equal_lengths(v)
```

Out[12]: False

```
In [13]: 1 # Check if the length of a vector is equal to the length of another
        2 (2 * CVC(-2, -1, 2, 0)).equal_lengths(CVC(15, 3, 3, -9) / 3)
```

Out[13]: True

```
In [14]: 1 # Check if a vector is shorter than another
        2 u = CVC(1, 3, -5, 1)
        3 v = CVC(-4, 0, 4, -2)
        4 u.shorter(v)
```

Out[14]: False

```
In [15]: 1 # Check if a vector is shorter than another
        2 u = CVC(5, -3, -1, -1)
        3 v = CVC(2, -5, 4, 2)
        4 u.shorter(v)
```

Out[15]: True

```
In [16]: 1 # Check if a vector is longer than another
        2 u = CVC(1, 3, -5, 1)
        3 v = CVC(-4, 0, 4, -2)
        4 u.longer(v)
```

Out[16]: False

```
In [17]: 1 # Check if a vector is longer than another
        2 u = CVC(-2, 2, 4, 5)
        3 v = CVC(1, -5, -1, 3)
        4 u.longer(v)
```

Out[17]: True

```
In [18]: 1 # Calculate the dot product of a vector and another
        2 u = CVC(-2, 1, -1, 3)
        3 v = CVC(2, 3, 0, -4)
        4 u.dot(v)
```

Out[18]: -13

```
In [19]: 1 # Calculate the dot product of a vector and another
        2 (CVC(-4, -1, -3, 1) + 2).dot(CVC(3, 4, 1, -3) - 1)
```

Out[19]: -13

```
In [20]: 1 # Calculate the length (magnitude) of a vector
        2 u = CVC(-2, -5, 4, 2)
        3 u.length()
```

Out[20]: 7.0

```
In [21]: 1 # Calculate the length of a vector
        2 (CVC(3, -2, -3, 7) - CVC(2, -7, -2, 4)).length()
```

Out[21]: 6.0

```
In [22]: 1 # Calculate the distance between a position vector and another
        2 u = CVC(3, -2, -3, 7)
        3 v = CVC(2, -7, -2, 4)
        4 u.distance(v)
```

Out[22]: 6.0

```
In [23]: 1 # Calculate the normalized vector of a vector (i.e. a vector in the same direction with length equal cunit)
        2 u = CVC(-4, 0, 0, 3)
        3 u.normalize()
```

Out[23]: CVC(A=-0.8, B=0.0, C=0.0, D=0.6)

```
In [24]: 1 # Calculate the projection of a vector onto another
2 u = CVC(9, -9, 0, 6)
3 v = CVC(0, 2, 1, -4)
4 w = u.project(v)
5 w
```

Out[24]: CVC(A=-0.0, B=-4.0, C=-2.0, D=8.0)

```
In [25]: 1 # Calculate the inverse of a projection of a vector onto another
2 w = CVC(-0, -4, -2, 8)
3 v = CVC(-3, 3, 0, -2)
4 u = w.inv_project(v)
5 u
```

Out[25]: CVC(A=9.0, B=-9.0, C=-0.0, D=6.0)

```
In [26]: 1 # Calculate the rejection of a vector from another
2 u = CVC(9, -9, 0, 6)
3 v = CVC(0, 2, 1, -4)
4 u.reject(v)
```

Out[26]: CVC(A=9.0, B=-5.0, C=2.0, D=-2.0)

```
In [27]: 1 # Calculate the scalar projection of a vector onto another
2 u = CVC(3, 0, 4, -1)
3 v = CVC(-6, 0, -8, 0)
4 u.scalar_project(v)
```

Out[27]: -5.0

```
In [28]: 1 # Calculate the smallest angle in radians between a vector and another
2 u = CVC(4.5, -3.0, 0.0, -1.5)
3 w = CVC(-3.0, -3.0, 0.0, -3.0)
4 u.angle(w) # = pi / 2
```

Out[28]: 1.5707963267948963

```
In [29]: 1 # Calculate the cosine of the smallest angle between a vector and another
2 u = CVC(-1, 0, 0, -1)
3 v = CVC(2, 0, -2, 2)
4 u.cos(v) # = -(2 / 3)**0.5
```

Out[29]: -0.8164965809277259

```
In [30]: 1 # Limit the resulting value to be greater than or equal to s*cunit and smaller than or equal to t*cunit
2 s = -1
3 t = 2
4 [
5     CVC.clip(i, s, t)
6     for i in [ -3, -2, -1, 0, 1, 2, 3, 4 ]
7 ]
```

Out[30]: [-1, -1, -1, 0, 1, 2, 2, 2]

```
In [ ]: 1
```