ECE 20875

Python for Data Science

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inheritance

reusing functionality

- We often want to reuse functionality from an existing class
  - A new class that has some extra functionality compared to an old class
  - Or that changes/overrides some functionality of an old class
- One option: create a new class and define all the necessary functions

```
class Person :
  def __init__(self, name) :
    self.name = name

  def getName(self) :
    return self.name

p = Person(“Bob”)
print(p.getName()) #prints “Bob”

class OldPerson :
  def __init__(self, name, age) :
    self.name = name
    self.age = age

  def getName(self) :
    return self.name

  def getAge(self) :
    return self.age
```

reusing functionality

- Instead we can use **inheritance**
  - Create a new class that *inherits* the attributes of the **parent** class
  - Can then add new attributes to a class to define new functions, add new data
- Note that __init__ was *overriden*
  - When we create a new OldPerson, we use the new version of __init__ but when we call getName() we use the old version of getName()

```
class Person :
  def __init__(self, name) :
    self.name = name

  def getName(self) :
    return self.name

p = Person(“Bob”)
print(p.getName()) #prints “Bob”

class OldPerson(Person) :
  def __init__(self, name, age) :
    self.name = name
    self.age = age

  def getAge(self) :
    return self.age
```

method overriding

- Can reuse functionality even more by calling “**super** class” functions
  - In this example, super().__init__() refers to __init__() of the parent class Person
  - No need to copy code from one __init__ function to another
- Can similarly reuse functionality when redefining other functions

```
class Person :
  def __init__(self, name) :
    self.name = name

  def getName(self) :
    return self.name

p = Person(“Bob”)
print(p.getName()) #prints “Bob”

class OldPerson(Person) :
  def __init__(self, name, age) :
    super().__init__(name)
    self.age = age

  def getAge(self) :
    return self.age
```

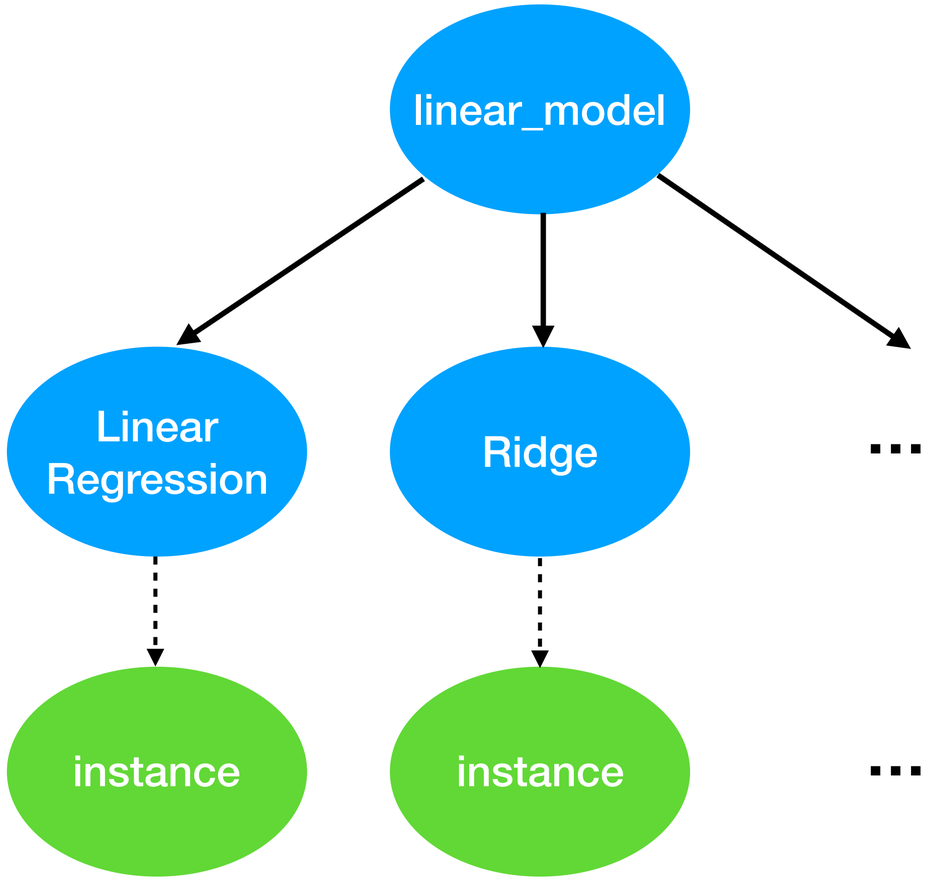
method overriding

- All classes inherit from the built-in basic class “**object**” by default
  - Provides some default functionality like __repr__ and __str__ methods
  - (__**repr**__ is more general than just printing, it is for inspecting objects and can return any data type)
  - Overriding these gives us the ability to change how objects are represented (__repr__) or printed (__str__ or __repr__)

```
class Person :
  def __init__(self, name) :
    self.name = name

  def getName(self) :
    return self.name

p = Person(“Bob”)
print(p.getName()) #prints “Bob”

class OldPerson(Person) :
  def __init__(self, name, age) :
    super().__init__(name)
    self.age = age

  def getAge(self) :
    return self.age

  def __repr__(self) :
    return name + “, “ + str(self.age)
```

uses of inheritance we've seen

- We've seen inheritance used in many Python packages we have used in this class
- Distribution classes (normal, exponential, etc.) in sklearn all inherit from generic classes that provide some default functionality
  - These classes override key methods (like pdf and cdf) to provide distribution-specific implementations
- Several regression models in sklearn inherit functionality from linear_model



what about polymorphism?

- You may have heard of **polymorphism** before
  - Call a function on an object, but invoke different functionality depending on exactly what class an object is
  - Can write very generic code since you do not have to know exactly what type of object you are working with
  - Used extensively in languages like Java and C++ through the inheritance mechanism
- Python gets you this “for free”:
  - Programs are not written with types
  - Invoke any method on any object if the object’s class has the method defined
  - No need for any actual relationship between different classes that implement the same method(s)

```
class Animal:
        def __init__(self, name): # Constructor of the class
                self.name = name
        def talk(self): # Abstract method, defined by convention only
                raise NotImplementedError("Subclass must implement
                                                abstract method")
class Cat(Animal):
        def talk(self):
                return 'Meow!'
class Dog(Animal):
        def talk(self):
                return 'Woof! Woof!'

animals = [Cat('Missy'), Cat('Mr. Mistoffelees'), Dog('Lassie')]
for animal in animals:
Print(animal.name + ': ' + animal.talk())
```