

ECE 20875

Python for Data Science

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**(Adapted from material developed by Profs. Milind Kulkarni,
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inheritance

reusing functionality

- We often want to reuse functionality from an existing class
 - When a new class that has some extra functionality compared to an old class
 - When a new class changes/overrides some functionality of an old class
- One option: Create a new class, and define all the necessary functions
 - This is done in the example on the right

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

    def getName(self) :
        return self.name

p = Person("Bob")
print(p.getName()) #prints "Bob"

#creating a new class that has a lot in
common with "Person"
class AgePerson :
    def __init__(self, name, age) :
        self.name = name
        self.age = age

    def getName(self) :
        return self.name

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

inheriting from parent class

- This is pretty inefficient if there is a lot of overlap
- Instead, we can use **inheritance**
 - Create a new **child** class that *inherits* the attributes of the **parent** class
 - Can then add new attributes to a class to define new functions and/or add new data
- Updated example using inheritance on the right:
 - `__init__` from AgePerson **overrides** `__init__` from Person
 - When we create a new AgePerson, 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())
```

```
#we can instead let the AgePerson class  
inherit from the parent class Person
```

```
class AgePerson(Person) :  
    #overrides __init__ from parent  
    def __init__(self, name, age) :  
        self.name = name  
        self.age = age
```

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

reusing when redefining

- Can reuse functionality even more by using the **super()** function within a child class
 - Tells the class to inherit this method/property from the parent, and allows further redefining
- Updated example on the right:
 - `super().__init__()` refers to `__init__()` of the parent class `Person`
 - This tells `AgePerson` to reuse `__init__` from `Person` in the redefinition, and then we can add additional functionality on top of it
- 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())
```

```
class AgePerson(Person) :  
    def __init__(self, name, age) :  
        #Tell AgePerson to inherit __init__  
        from parent class  
        super().__init__(name)
```

```
        #Then we can add additional  
        functionality to the new init  
        self.age = age
```

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

overriding default methods

- All classes inherit from the built-in basic class called **object** by default
 - Provides some default functionality like `__str__` and `__repr__` methods
 - `__repr__` is the “official” string representation of an object, more general than just printing, useful for debugging
 - `__str__` is the “informal” string representation of an object, used for creating readable end user output
- 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())
```

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

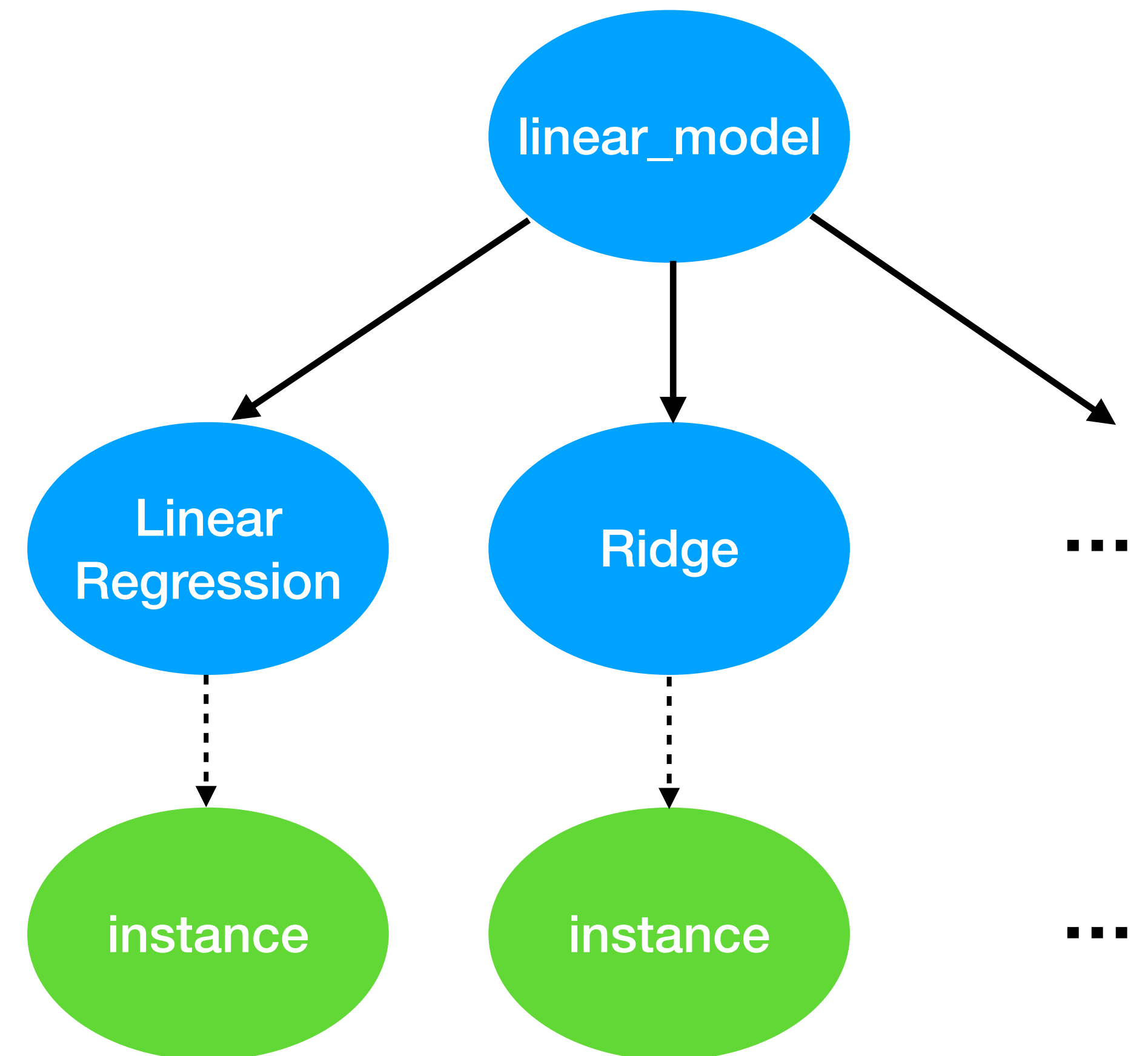
```
    def getAge(self) :  
        return self.age
```

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

```
p = AgePerson("Bob", 33)  
repr(p)    #prints 'Bob, 33'
```

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 or interfaces?

- 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 (called **duck typing**)
 - No need for any actual relationship between different classes that implement the same method(s)

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

    def talk(self) :
        raise NotImplementedError("Subclass
                                   must implement talk method")

class Cat(Animal) :
    def talk(self):
        return 'Meow!'

class Duck: # Notice doesn't inherit
    def __init__(self, name) :
        self.name = name # But has the right var.
    def talk(self): # And implements this method
        return 'Quack! Quack!'

animals = [Cat('Missy'), Cat('Mr. Mistoffelees'),
           Duck('Sammy')]

for animal in animals:
    print(animal.name + ': ' + animal.talk())
```

IF IT LOOKS LIKE A DUCK,
AND QUACKS LIKE A DUCK,
IT'S A DUCK.