Machine Learning

from Development to Production at Instacart

Montana Low
Machine Learning Engineer, Instacart

Instacart value proposition

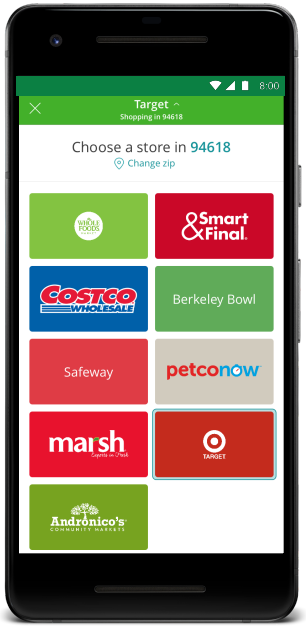
Groceries + From stores you love + Delivered to your doorstep + In as little as an hour =

instacart

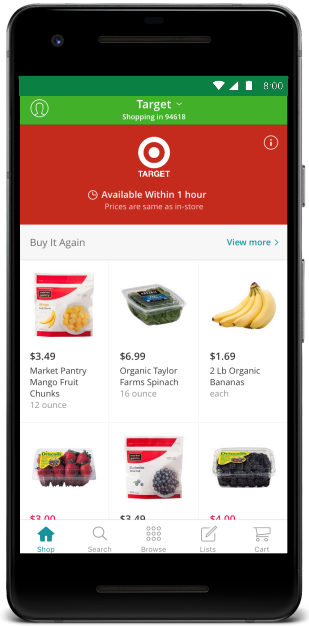
Four sided marketplace

instacart

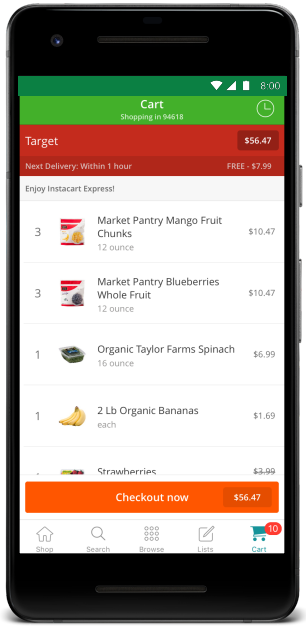
Customer experience



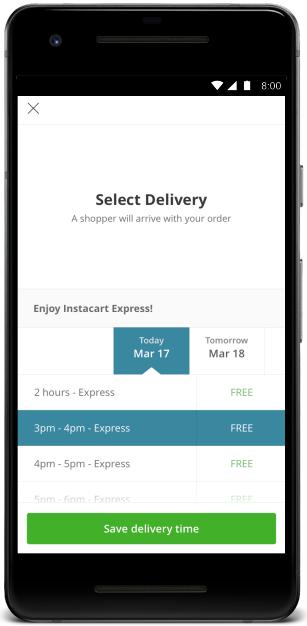
Choose a store



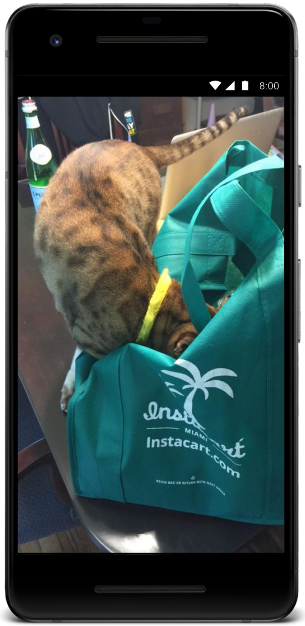
Shop for groceries



Checkout



Select delivery time



Delivered to doorstep

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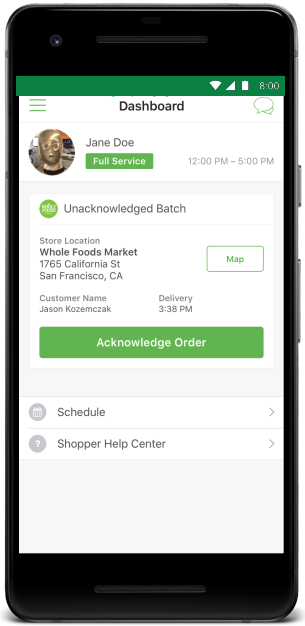
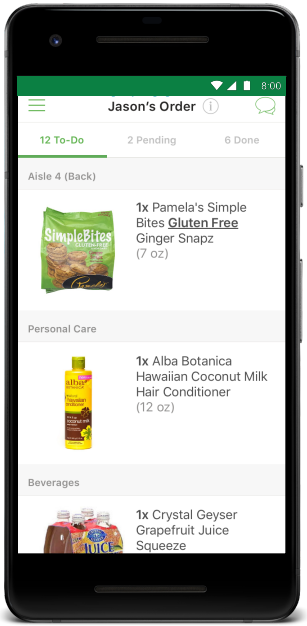
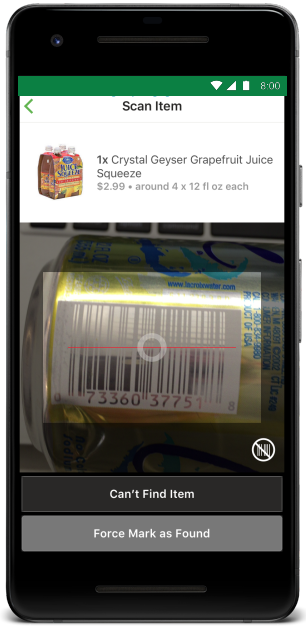
Personal shopper experience



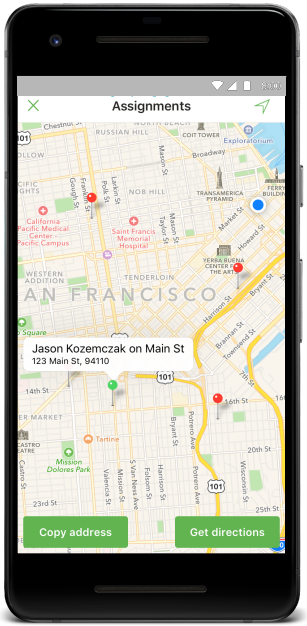
Accept order



Find the groceries



Scan barcode



Out for delivery

Delivered to doorstep

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Search & discovery

Supervised learning

Milk

Milk chocolate

Chocolate milk

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Features

- Brand
- Fat Content
- USDA Grade
- Organic?
- Pasteurized?
- Homogenized?
- Volume
- Geography
- …
- Dominant Color

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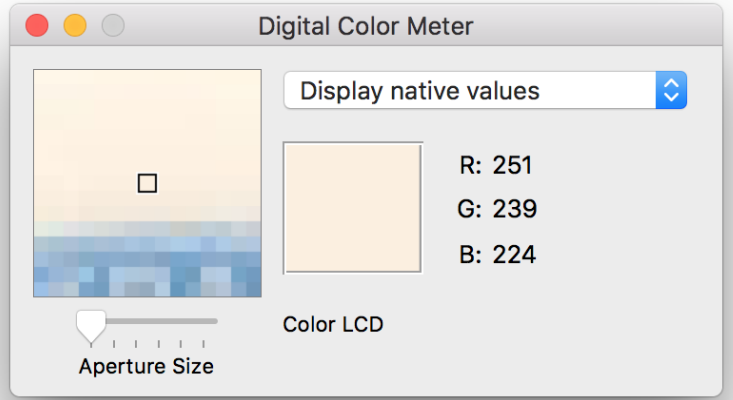
Encoding



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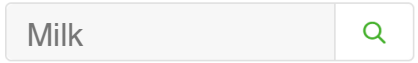
Supervised learning



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New products

- Kirkland signature
- 2% Fat
- Milk
- Vitamin A
- Vitamin D
- Grade A
- Pasteurized
- Homogenized
- 1 gallon
- 2 count
- …
- Tertiary color

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Competitive products

Cola

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Recommended products

Peanut butter

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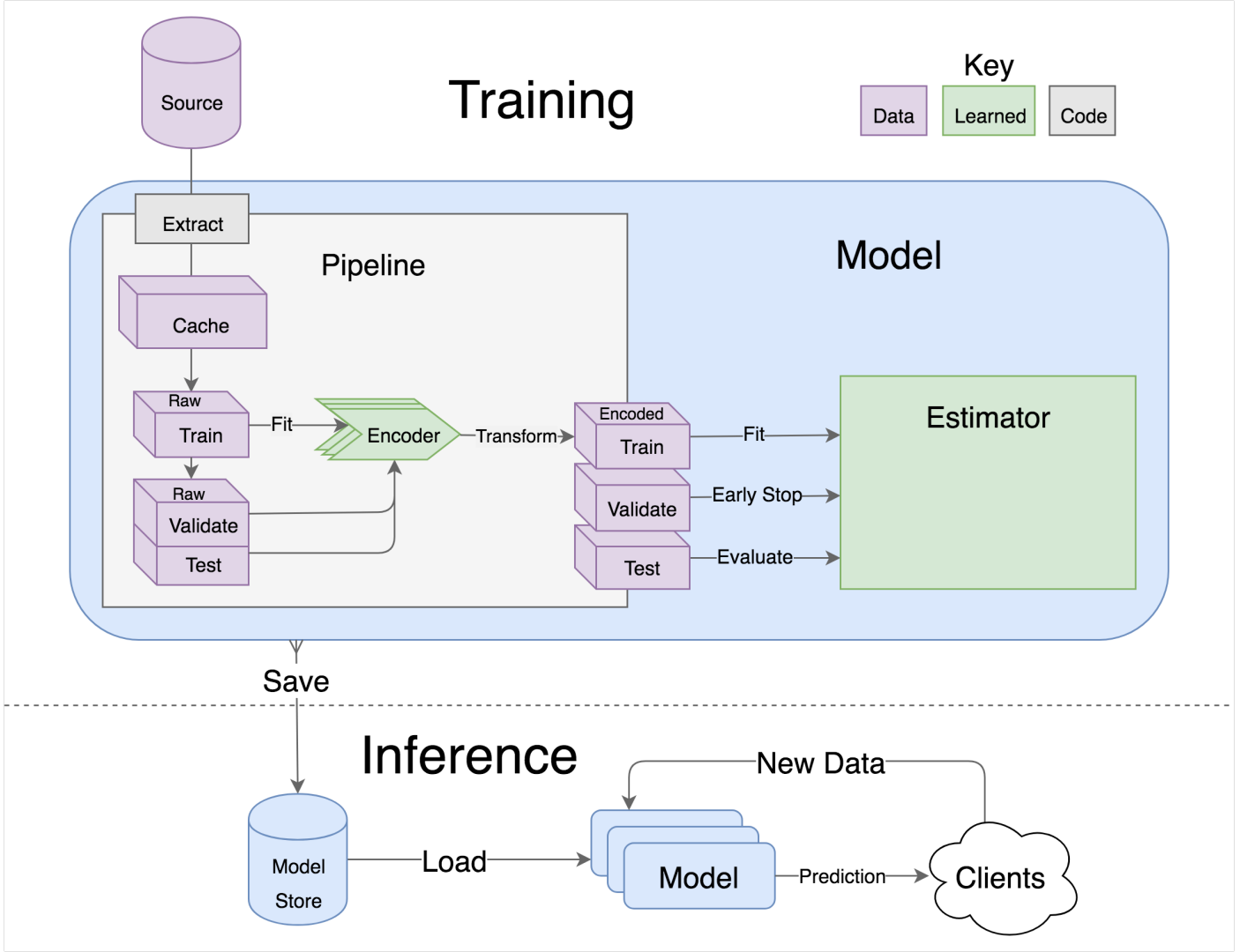
Project implementation w/ Lore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Raw
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Save
Inference
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Model
Store
Load
Model
Prediction
Clients

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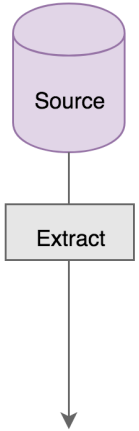
Create a project and model

```
$ pip install lore
$ lore init loss_prevention
$ lore generate scaffold delivery_disputes --regression

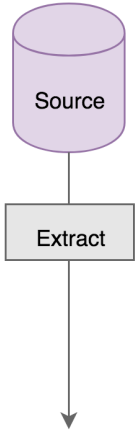
loss_prevention in development on montanalow@localhost
CREATED loss_prevention/models/delivery_disputes.py
CREATED loss_prevention/estimators/delivery_disputes.py
CREATED loss_prevention/pipelines/delivery_disputes.py
CREATED tests/unit/test_delivery_disputes.py
CREATED notebooks/delivery_disputes/features.ipynb
CREATED notebooks/delivery_disputes/architecture.ipynb
```

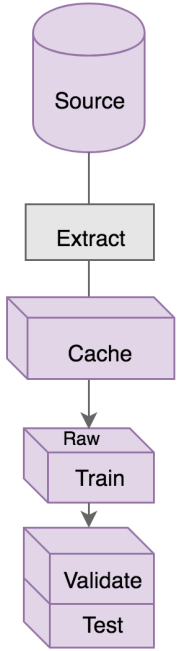


Extract

loss_prevention/extracts/credit_card_disputes.sql

```
SELECT
  visits.ip_address,
  deliveries.latitude,
  deliveries.longitude,
  charge_logs.is_disputed
FROM deliveries
JOIN visits ON visits.id = deliveries.visit_id
JOIN charge_logs ON charge_logs.id = deliveries.charge_id
```

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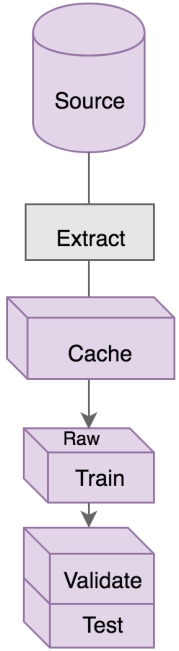
Pipeline

loss_prevention/pipelines/credit_card_disputes.py

```
class Pipeline(lore.pipelines.holdout.Base):

    @timed(logging.INFO)
    def get_data(self):
        return lore.io.redshift.dataframe(
            filename='credit_card_disputes',
            cache=True
        )
```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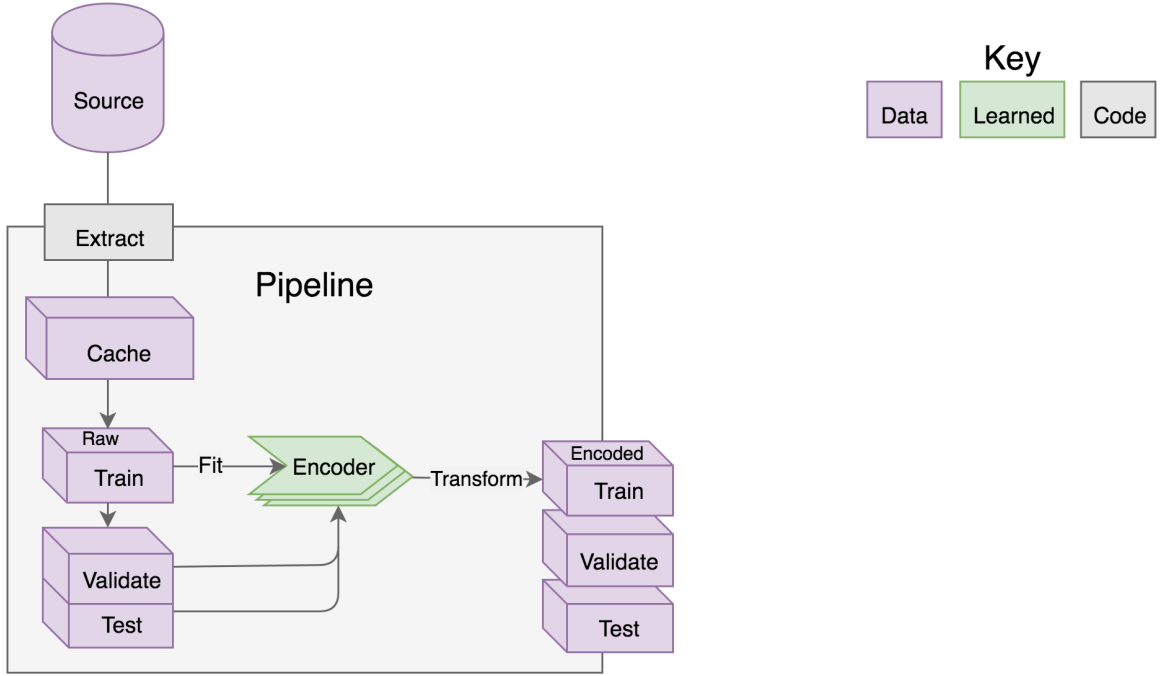
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Pipeline

loss_prevention/pipelines/credit_card_disputes.py

```
class Pipeline(lore.pipelines.holdout.Base):
    ...

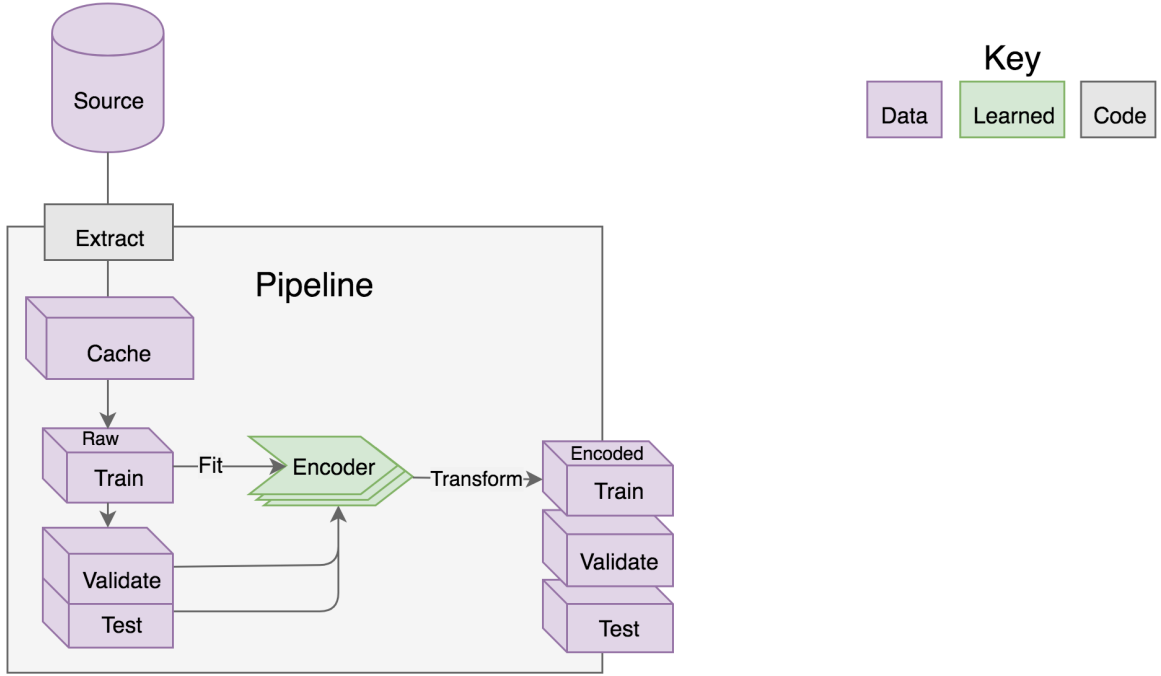
    def get_encoders(self):
        return (
            Norm(
                    Distance(
                        'latitude',
                        'longitude',
                        GeoIP('ip_address', 'latitude'),
                        GeoIP('ip_address', 'longitude')
                    )
            ),
        )
```

Pipeline

loss_prevention/pipelines/credit_card_disputes.py

```
class Pipeline(lore.pipelines.holdout.Base):
    ...

    def get_output_encoder(self):
        return Pass('is_disputed')
```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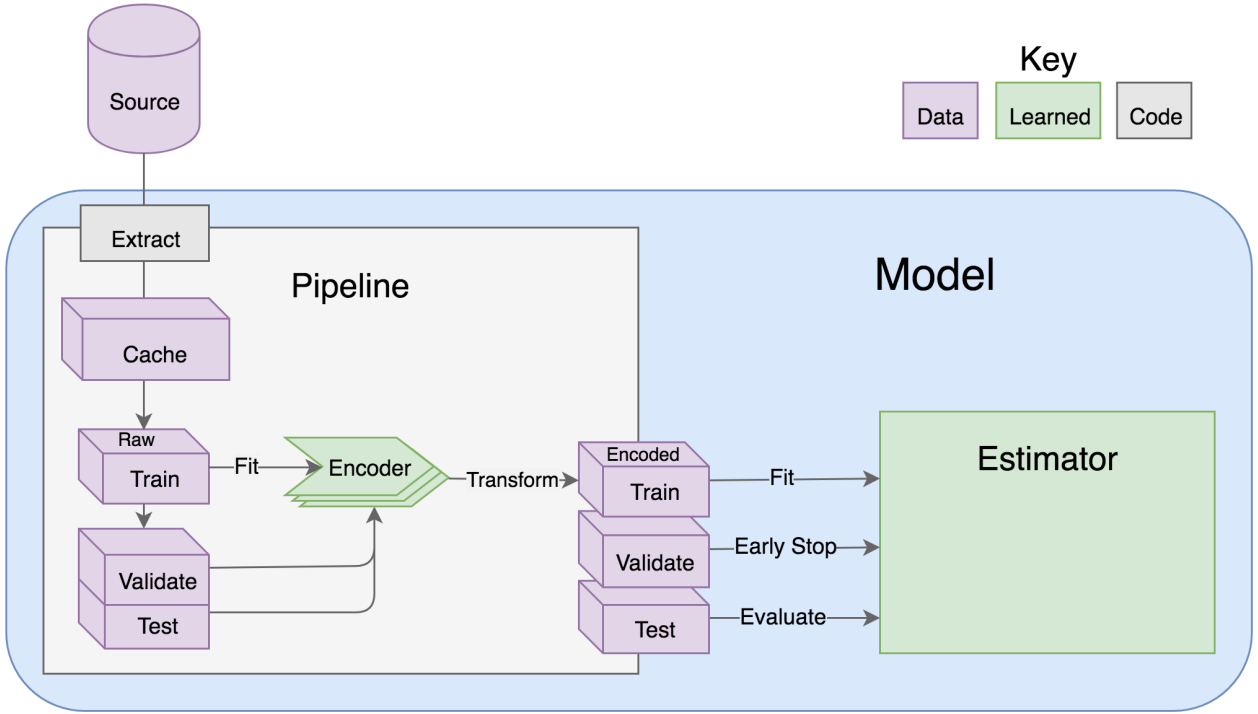
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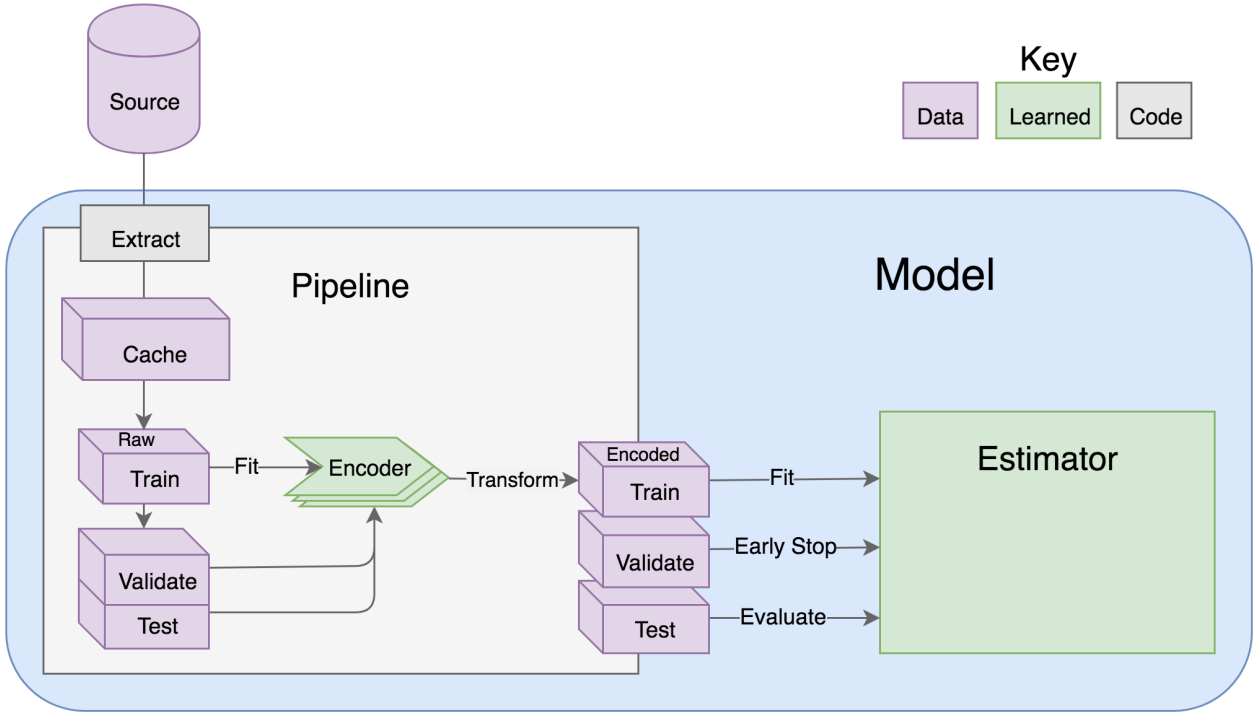
Evaluate
Test

Model

loss_prevention/models/credit_card_disputes.py

```
from loss_prevention.pipelines.credit_card_diputes import Pipeline

class DeepLearning(lore.models.keras.Base):
  def __init__(self):
    super(DeepLearning, self).__init__(
      pipeline=Pipeline(),
      estimator=lore.estimators.keras.BinaryClassifier()
    )
```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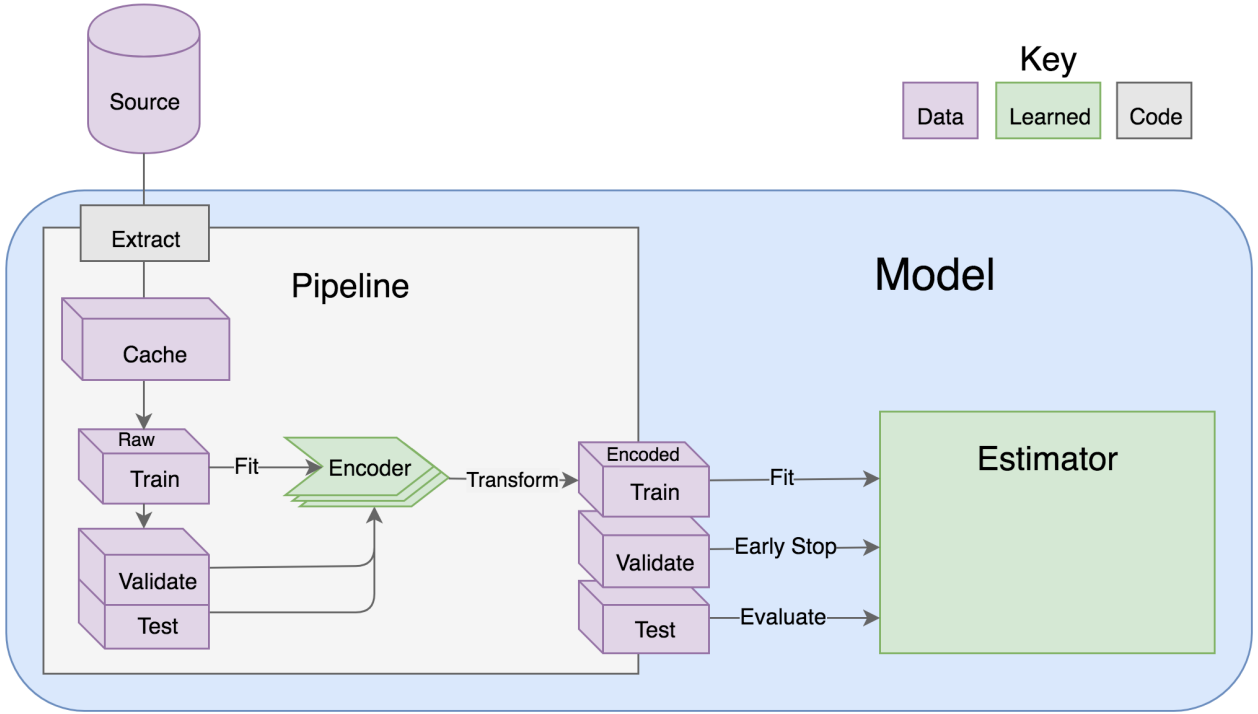
Test

Run tests

```
$ lore test

loss_prevention in test on montanalow@localhost
RUNNING all tests
..
----------------------------------------------
Ran 2 tests in 3.846s

OK
```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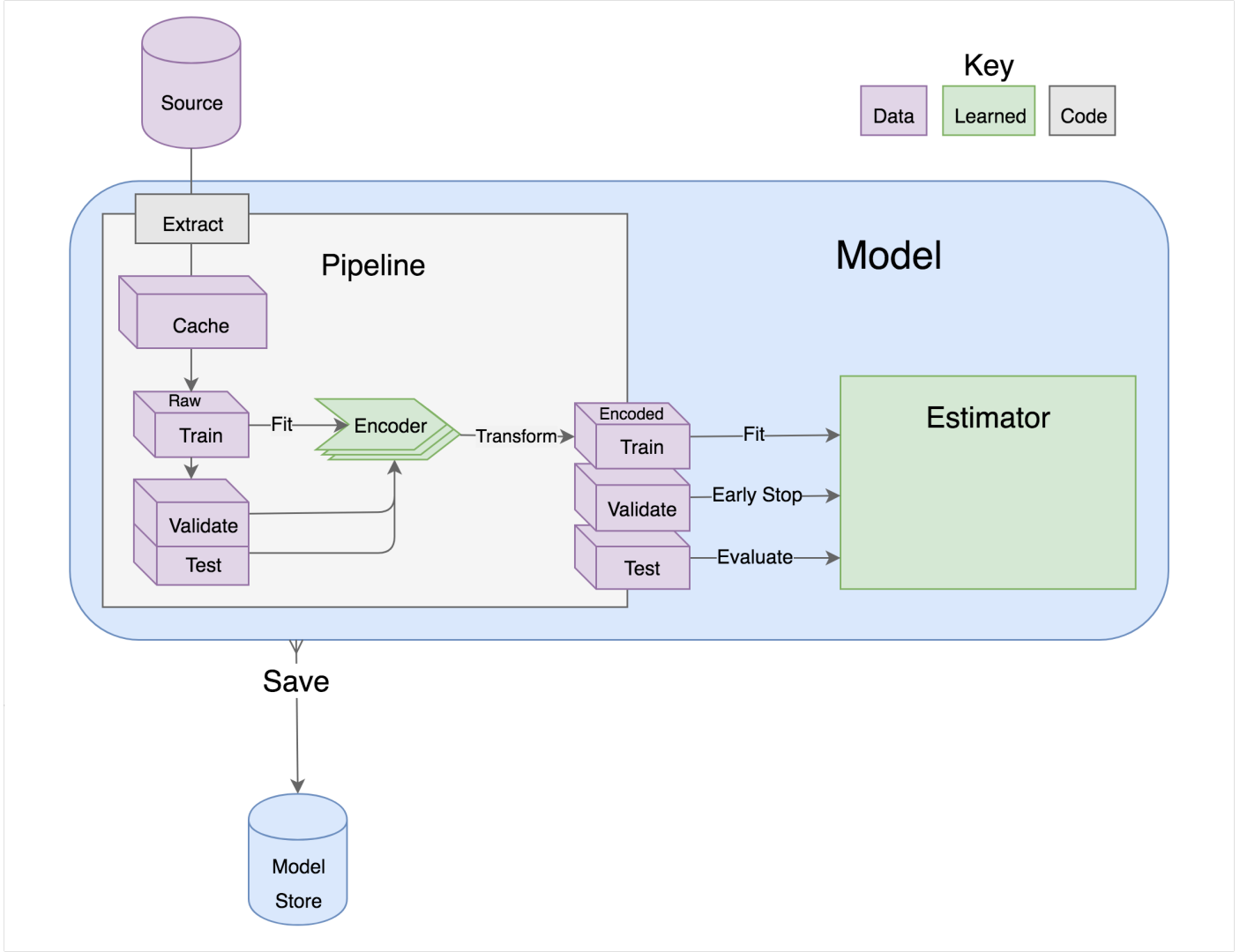
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Save
Model
Store

Train the model

```
$ lore fit loss_prevention.models.delivery_disputes.DeepLearning

loss_prevention in development on montanalow@localhost
Using TensorFlow backend. Train on 80 samples, validate on 10 samples

Epoch 1 32/80 [===========>.............] - ETA: 15s - loss: 1.5831
```

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Early Stopping

```
$ lore fit loss_prevention.models.delivery_disputes.DeepLearning

loss_prevention in development on montanalow@localhost
Using TensorFlow backend. Train on 80 samples, validate on 10 samples

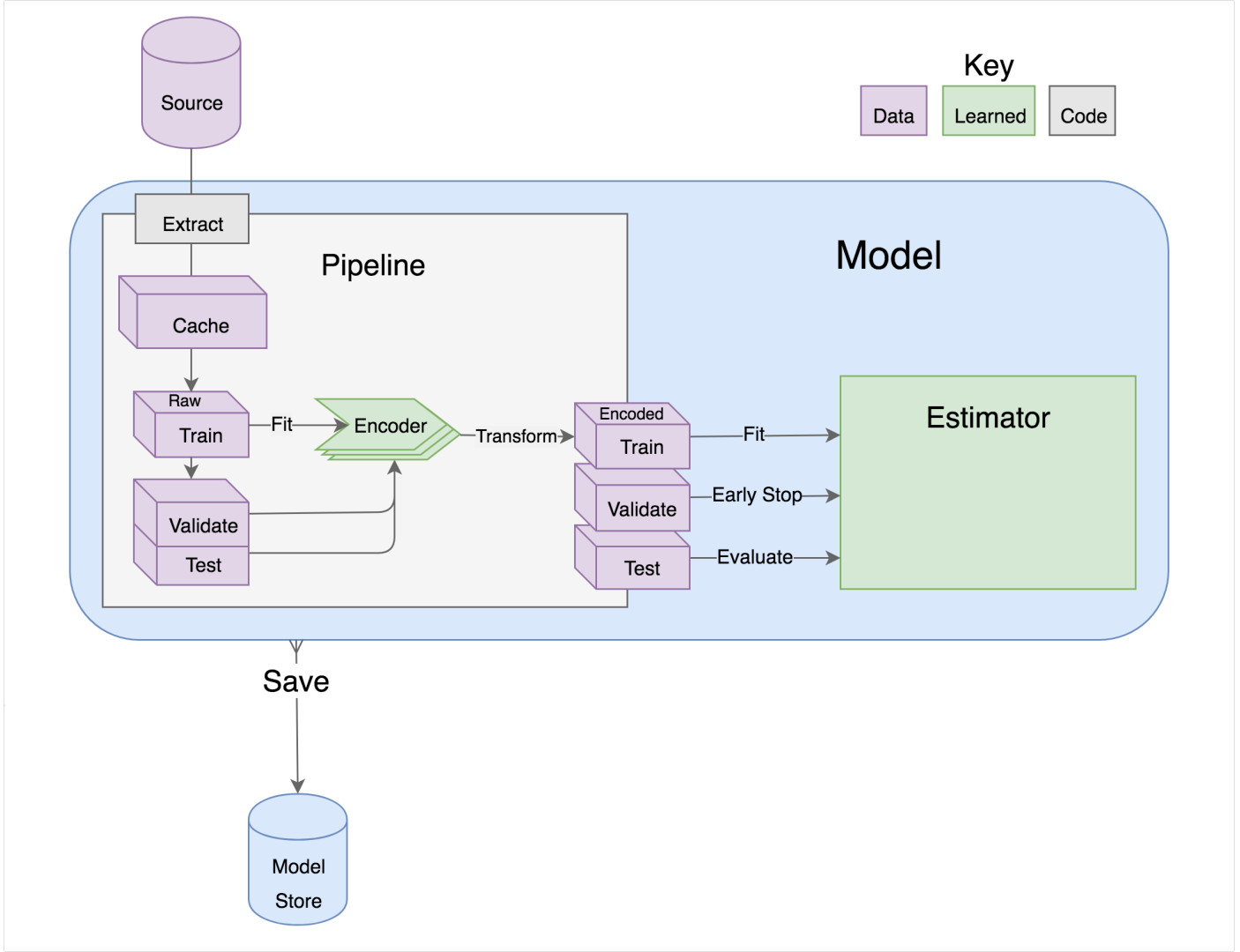
...

Epoch 57 80/80 [==========================] - loss: 0.55 val_loss: 0.58

Epoch 58 80/80 [==========================] - loss: 0.53 val_loss: 0.57

Epoch 59 80/80 [==========================] - loss: 0.52 val_loss: 0.58

Early Stopping
```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Important Files

```
requirements.txt
runtime.txt

config/
  database.cfg

data/query_cache/
  loss_prevention.pipelines.delivery_disputes.Pipeline.get_data.XY.pickle

models/loss_prevention.models.delivery_disputes/DeepLearning/1/
  model.pickle
  weights.h5

logs/
  development.log
```

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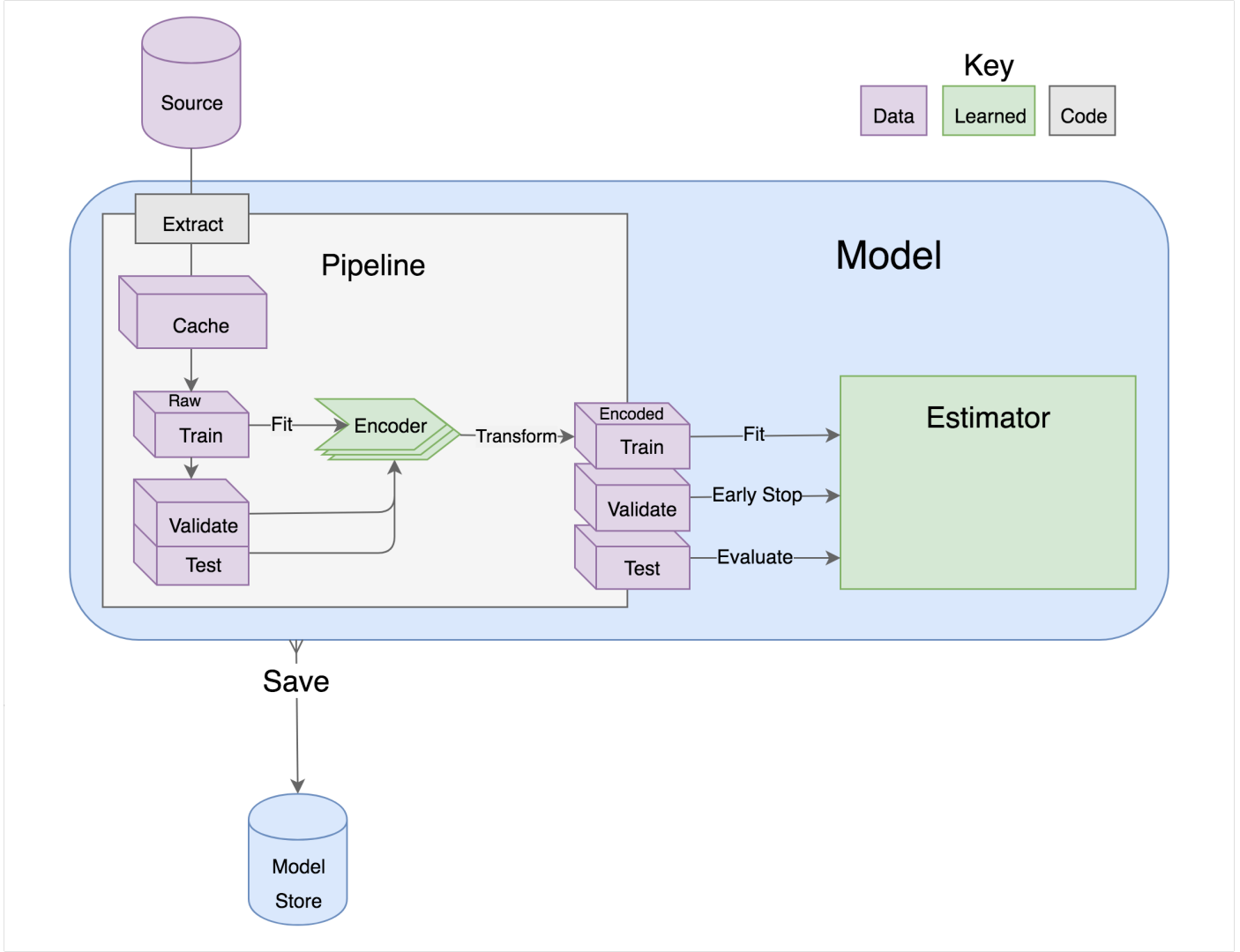
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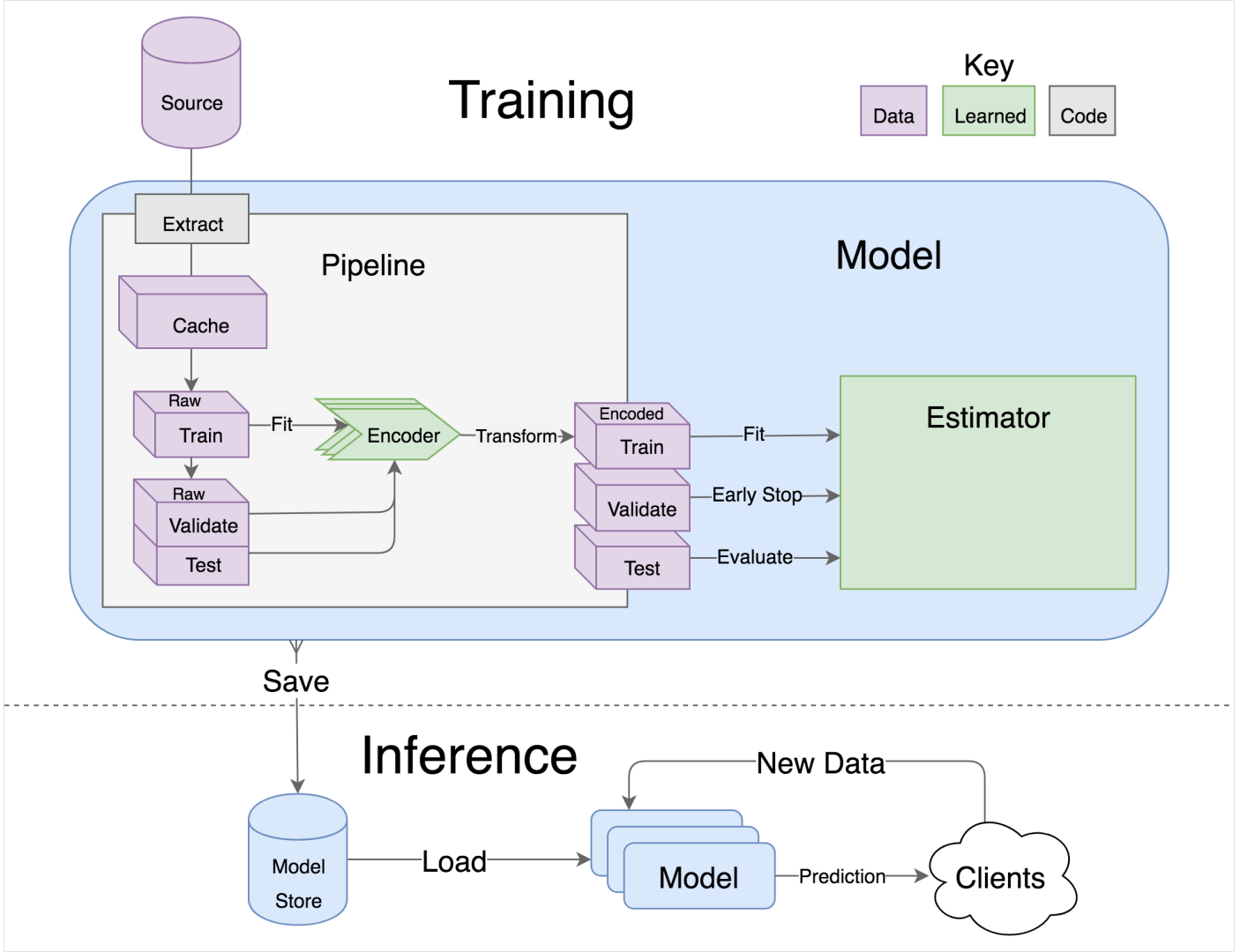
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Inference
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Clients

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Extract

loss_prevention/extracts/credit_card_disputes.sql

```
SELECT
  visits.ip_address,
  deliveries.latitude,
  deliveries.longitude,
  charge_logs.is_disputed
FROM deliveries
JOIN visits ON visits.id = deliveries.visit_id
JOIN charge_logs ON charge_logs.id = deliveries.charge_id
```

Extract

loss_prevention/extracts/credit_card_disputes.sql.j2

```
SELECT
  visits.ip_address,
  deliveries.latitude,
  deliveries.longitude,
  charge_logs.is_disputed
FROM deliveries
JOIN visits ON visits.id = deliveries.visit_id
JOIN charge_logs ON charge_logs.id = deliveries.charge_id
{% if delivery_id %}
WHERE deliveries.id = {delivery_id}
{% endif %}
```

Pipeline

loss_prevention/pipelines/credit_card_disputes.py

```
class Pipeline(lore.pipelines.holdout.Base):

    @timed(logging.INFO)
    def get_data(self):
        return lore.io.redshift.dataframe(
            filename='credit_card_disputes',
            cache=True
        )
```

Pipeline

loss_prevention/pipelines/credit_card_disputes.py

```
class Pipeline(lore.pipelines.holdout.Base):

    @timed(logging.INFO)
    def get_data(self, delivery_id=None):
        if delivery_id:
            interpolate = {'delivery_id': delivery_id}
            connection = lore.io.postgres
            cache = False
        else:
            interpolate = {}
            connection = lore.io.redshift
            cache = True

        sql=connection.template('delivery_disputes', delivery_id=delivery_id)
        return connection.dataframe(sql=sql, cache=cache, **interpolate)
```

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Model

loss_prevention/models/credit_card_disputes.py

```
from loss_prevention.pipelines.credit_card_diputes import Pipeline

class DeepLearning(lore.models.keras.Base):
  def __init__(self):
    super(DeepLearning, self).__init__(
      pipeline=Pipeline(),
      estimator=lore.estimators.keras.BinaryClassifier()
    )
```

Model

loss_prevention/models/credit_card_disputes.py

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from loss_prevention.pipelines.credit_card_diputes import Pipeline

class DeepLearning(lore.models.keras.Base):
  def __init__(self):
    super(DeepLearning, self).__init__(
      pipeline=Pipeline(),
      estimator=lore.estimators.keras.BinaryClassifier()
    )

  @timed(logging.INFO)
  def predict(self, dataframe):
    data = self.pipeline.get_data(delivery_id=dataframe.delivery_id)
    return self.estimator.predict(data)
```

Lore Server

```
$ lore server &

loss_prevention in development on montanalow@localhost
Using TensorFlow backend.
* Serving Flask app "lore.www"



$ curl http://localhost:5000/delivery_disputes.DeepLearning/predict.json -d "delivery_id=123"

True
```

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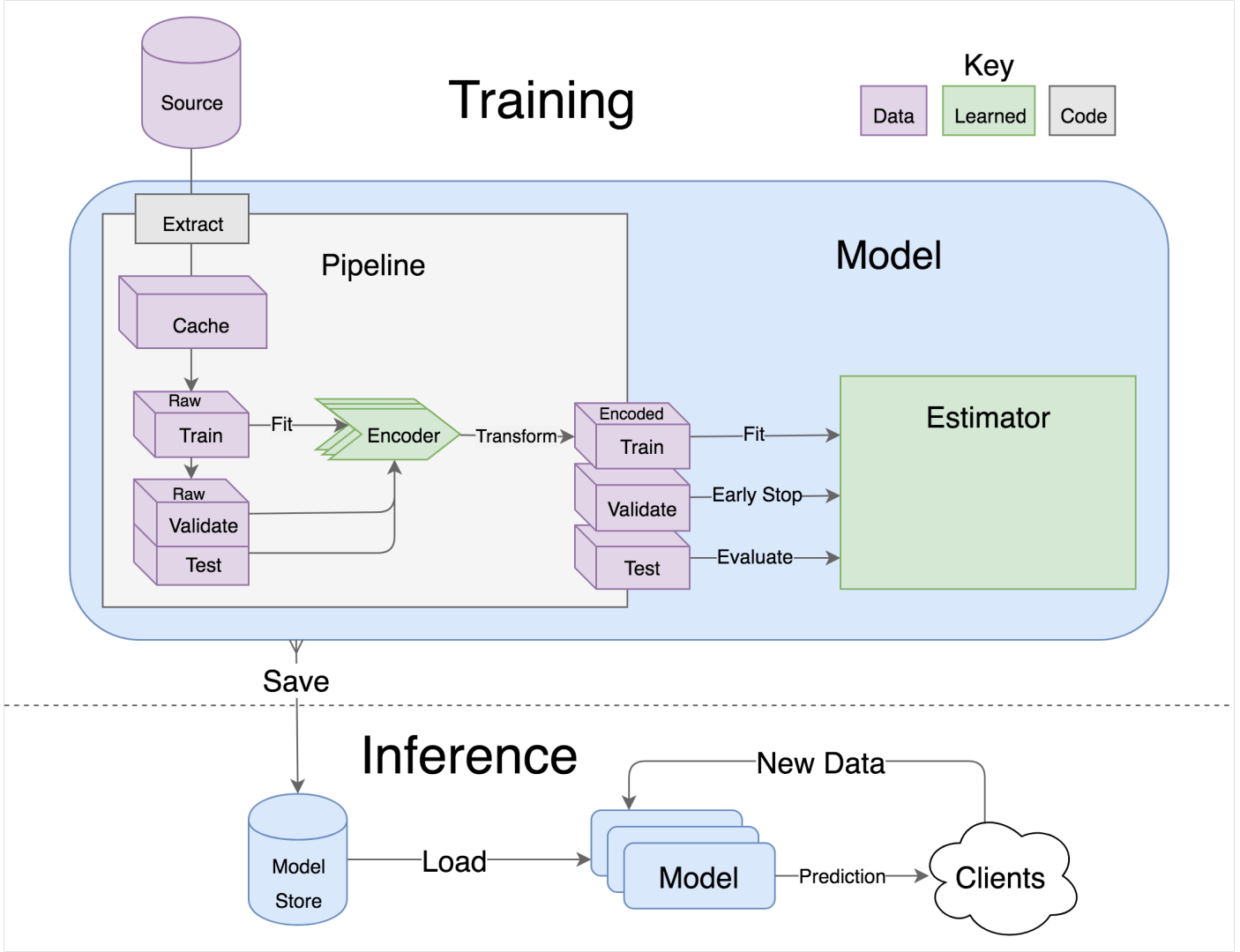
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Transformers

- GeoIP
- Distance
- DateTime
- String
- EmailDomain
- AreaCode
- Log/PlusOne
- ...
- NameAge
- NameSex
- NameFamilial
- NamePopulation

Encoders

- Norm
- Quantile
- Discrete
- Boolean
- Enum
- Unique
- Token
- Glove
- MiddleOut
- Equals

Algorithms

- Keras/Tensorflow
- XGBoost
- SciKit Learn

WE’RE HIRING!

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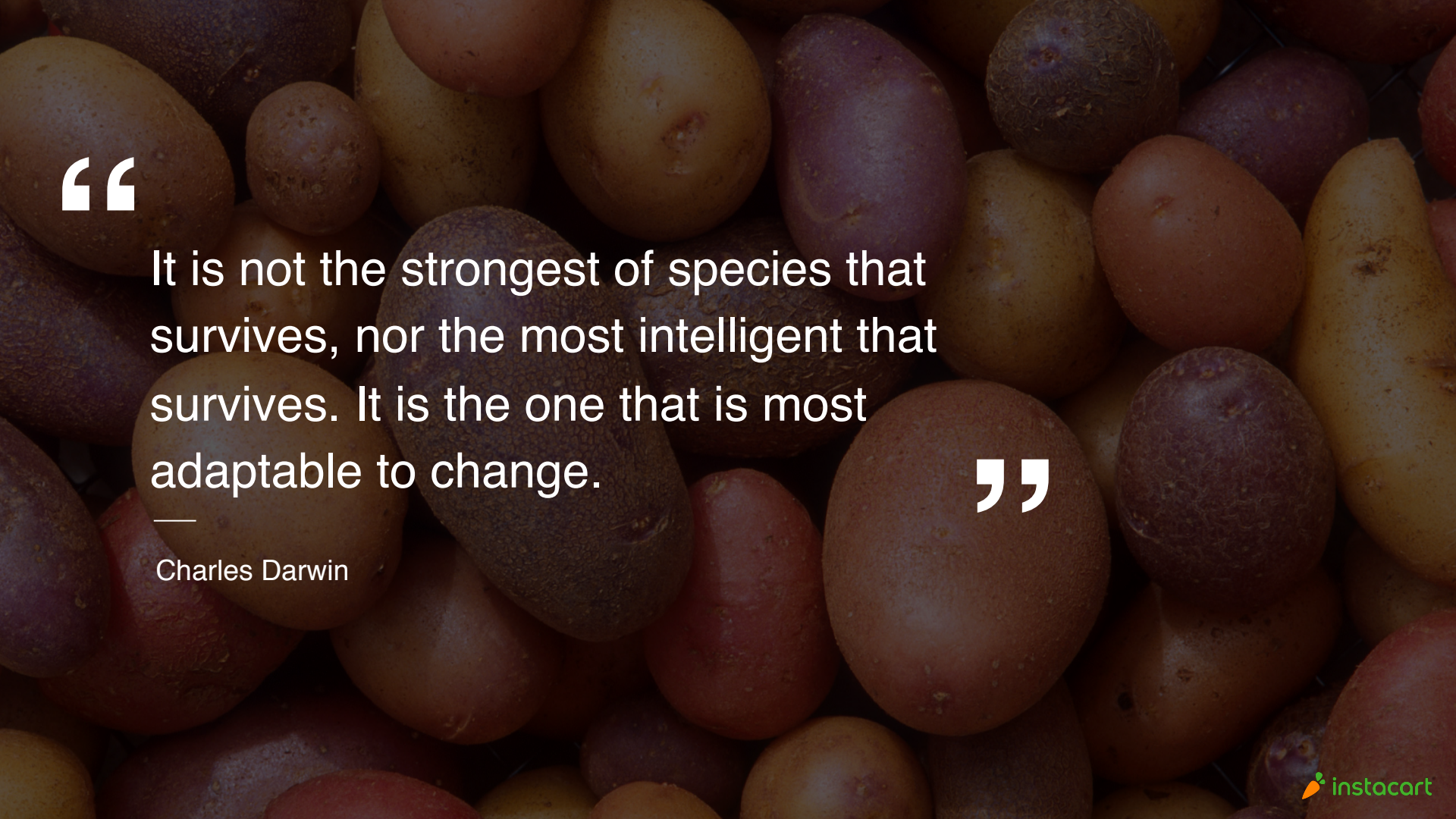
“
It is not the strongest of species that survives, nor the most intelligent that survives. It is the one that is most adaptable to change.
”
—
Charles Darwin
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