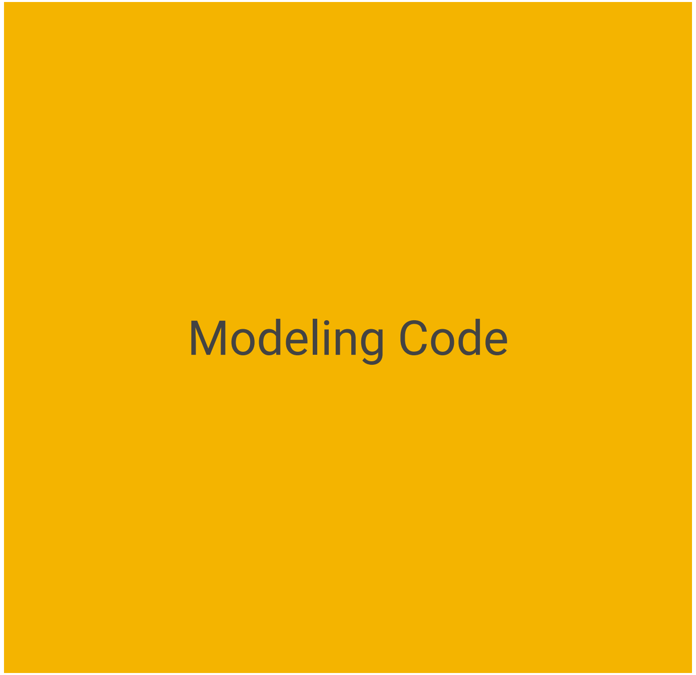
TensorFlow

NSL in TensorFlow Extended (TFX)

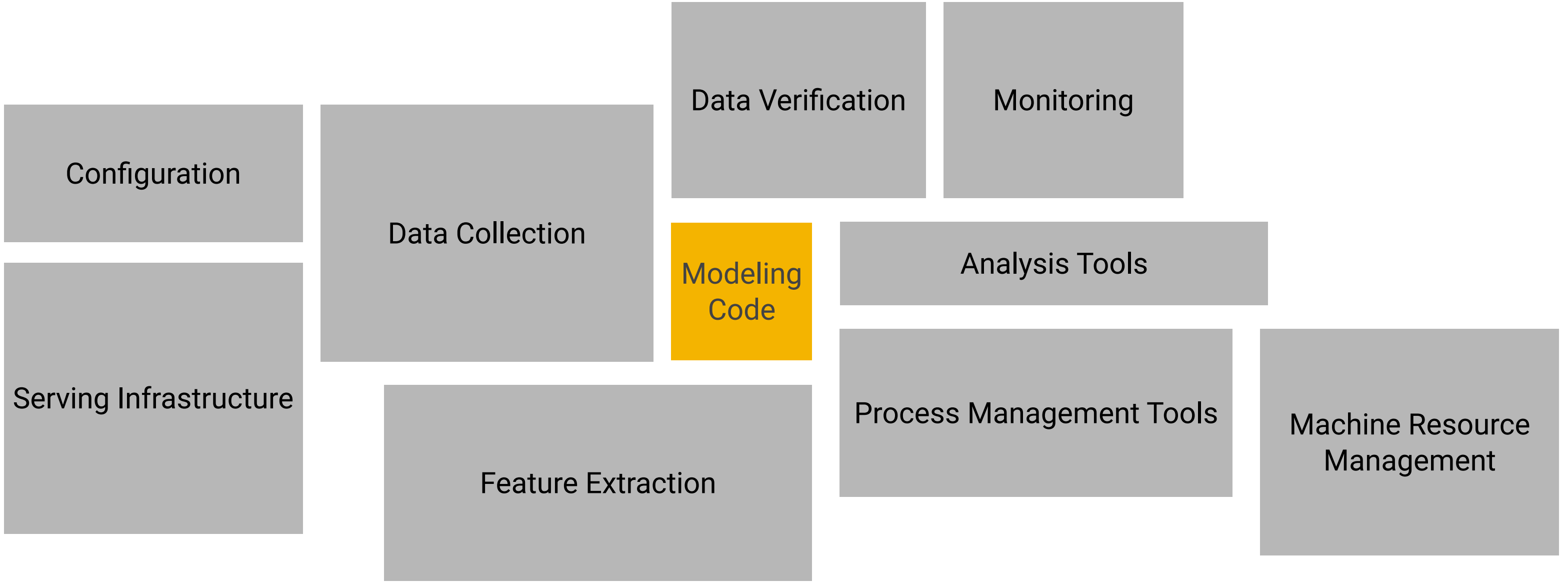
Arjun Gopalan

ML in Research



Modeling Code

ML in Production



Data Verification

Monitoring

Configuration

Data Collection

Modeling Code

Analysis Tools

Serving Infrastructure

Process Management Tools

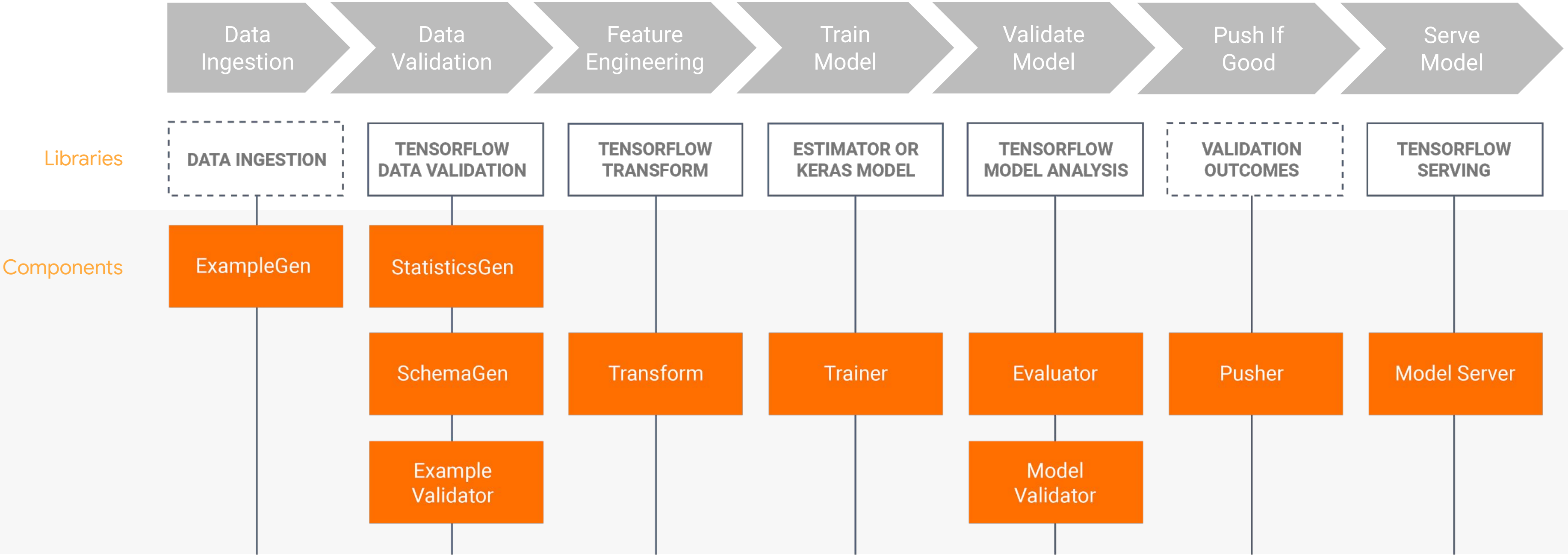
Machine Resource Management

Feature Extraction

What is TFX?

- Production-scale ML platform based on TensorFlow
- MLOps to automate, manage, and audit ML workflows
  - Data preparation and analysis
  - Model training and evaluation
  - Model deployment for production
- Leverage distributed resources for large workloads
- Orchestrate ML workflows on platforms like Apache Airflow, Apache Beam, and Kubeflow Pipelines
- OSS version of what Google uses for production ML

TFX Production Components

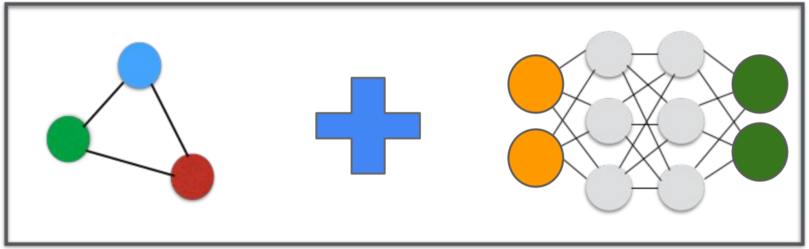


	Data Ingestion	Data Validation	Feature Engineering	Train Model	Validate Model	Push If Good	Serve Model
Libraries	DATA INGESTION	TENSORFLOW DATA VALIDATION	TENSORFLOW TRANSFORM	ESTIMATOR OR KERAS MODEL	TENSORFLOW MODEL ANALYSIS	VALIDATION OUTCOMES	TENSORFLOW SERVING
Components	ExampleGen	StatisticsGen SchemaGen Example Validator	Transform	Trainer	Evaluator Model Validator	Pusher	Model Server

Recap: Regularization in NSL

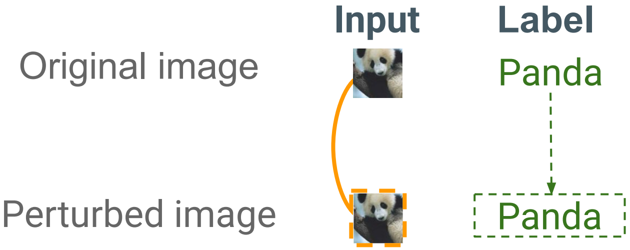
Graph regularization

- Graph building
- Training data augmentation
- Regularizing with graph neighbors during training



Adversarial regularization

- No preprocessing required
- Regularizing with adversarial neighbors dynamically generated during training



Input

Label

Original image

Panda

Perturbed image

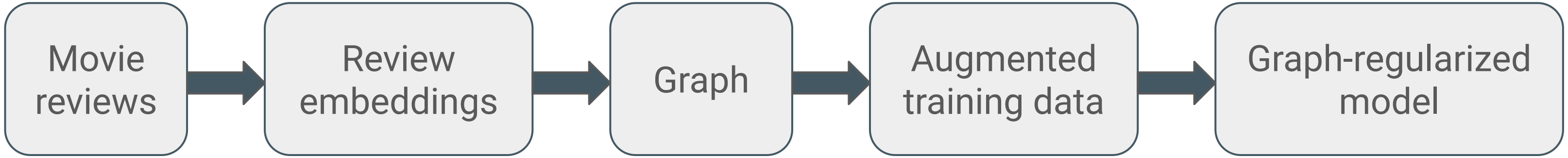
Panda

Graph regularization in TFX

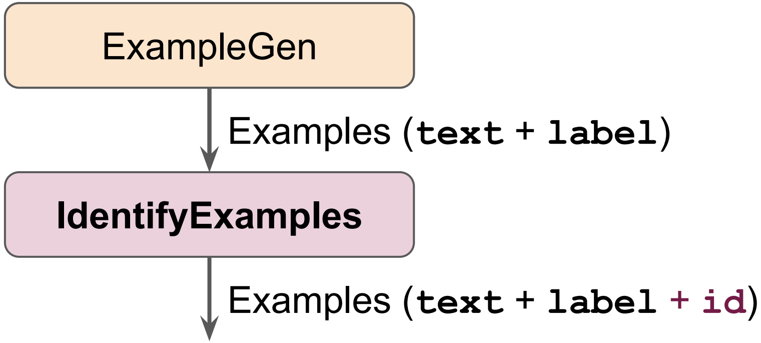
- Data preprocessing tasks in NSL don’t map directly to default TFX components
- Define **custom** TFX components instead
  - Class + I/O type definitions + processing_fn
- Existing TFX components + new **custom** components ⇒ TFX pipeline for NSL
- Flexible and intuitive!

Sentiment classification example

Classify movie reviews as good or bad



Example colab notebook

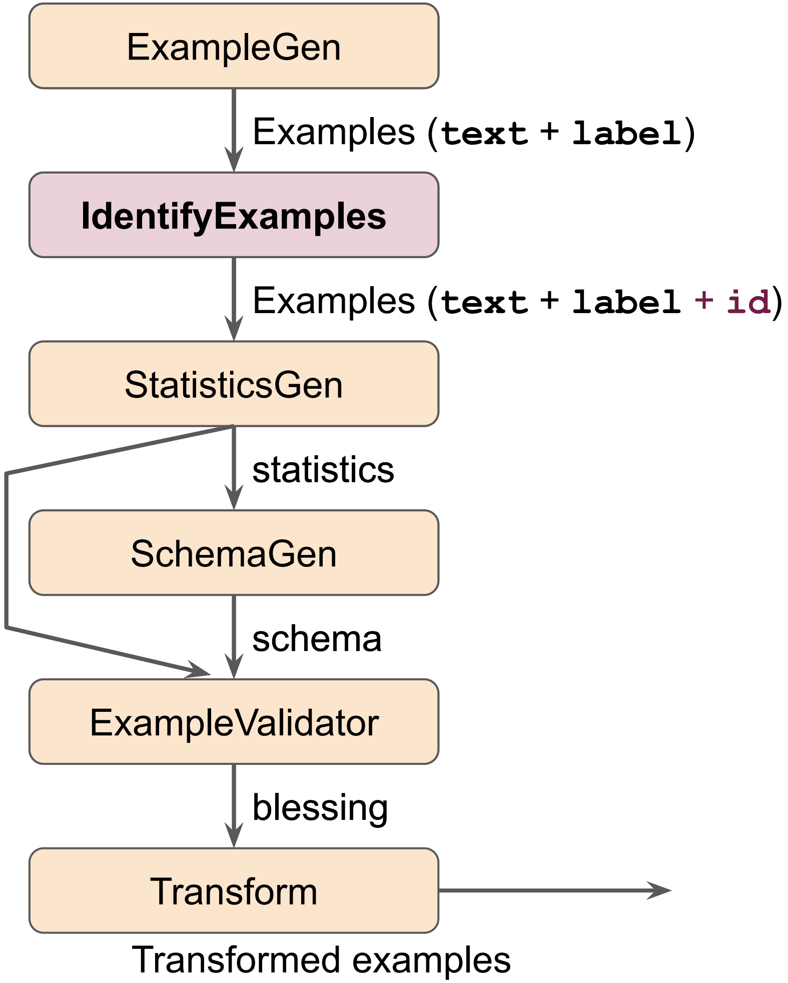


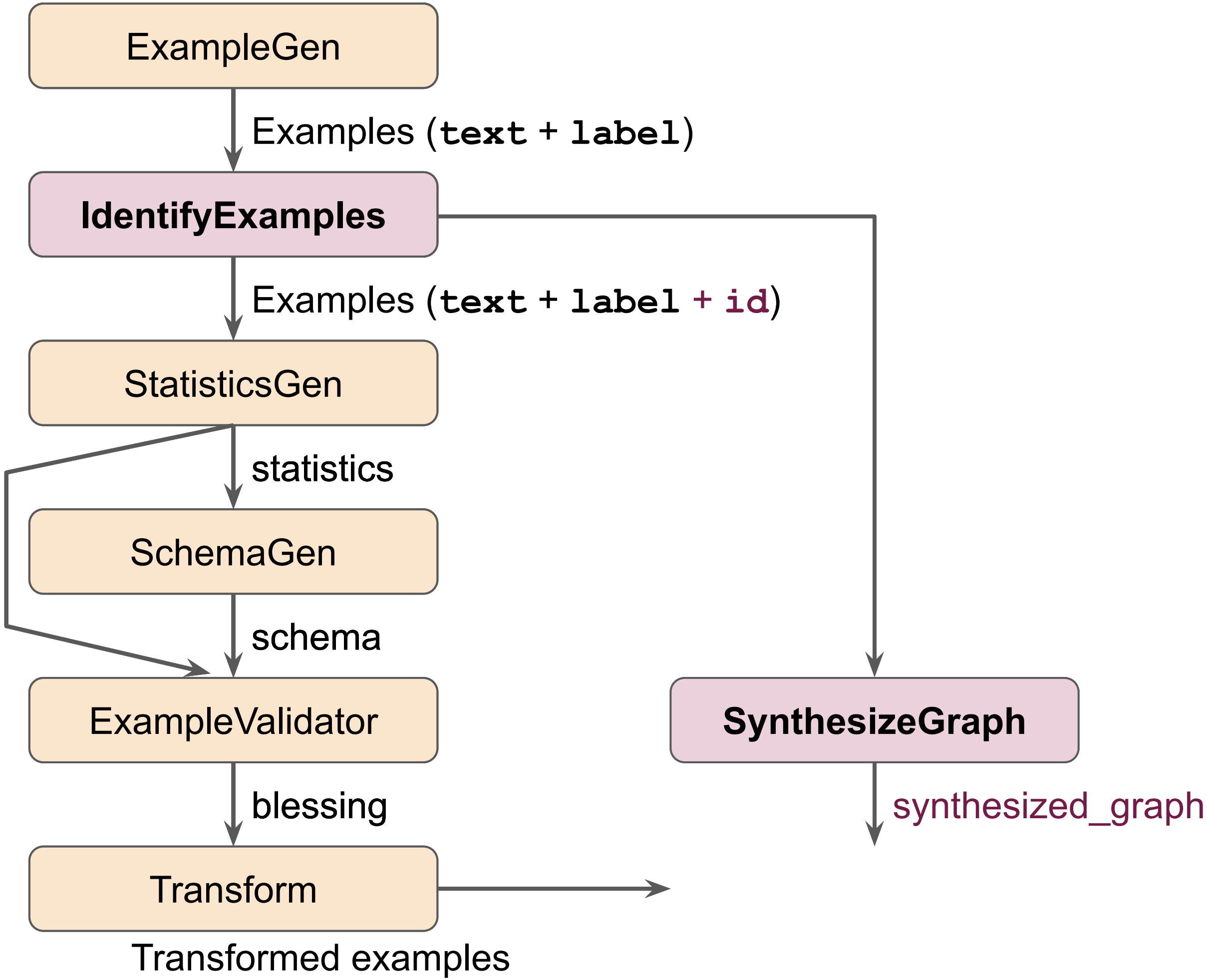
ExampleGen

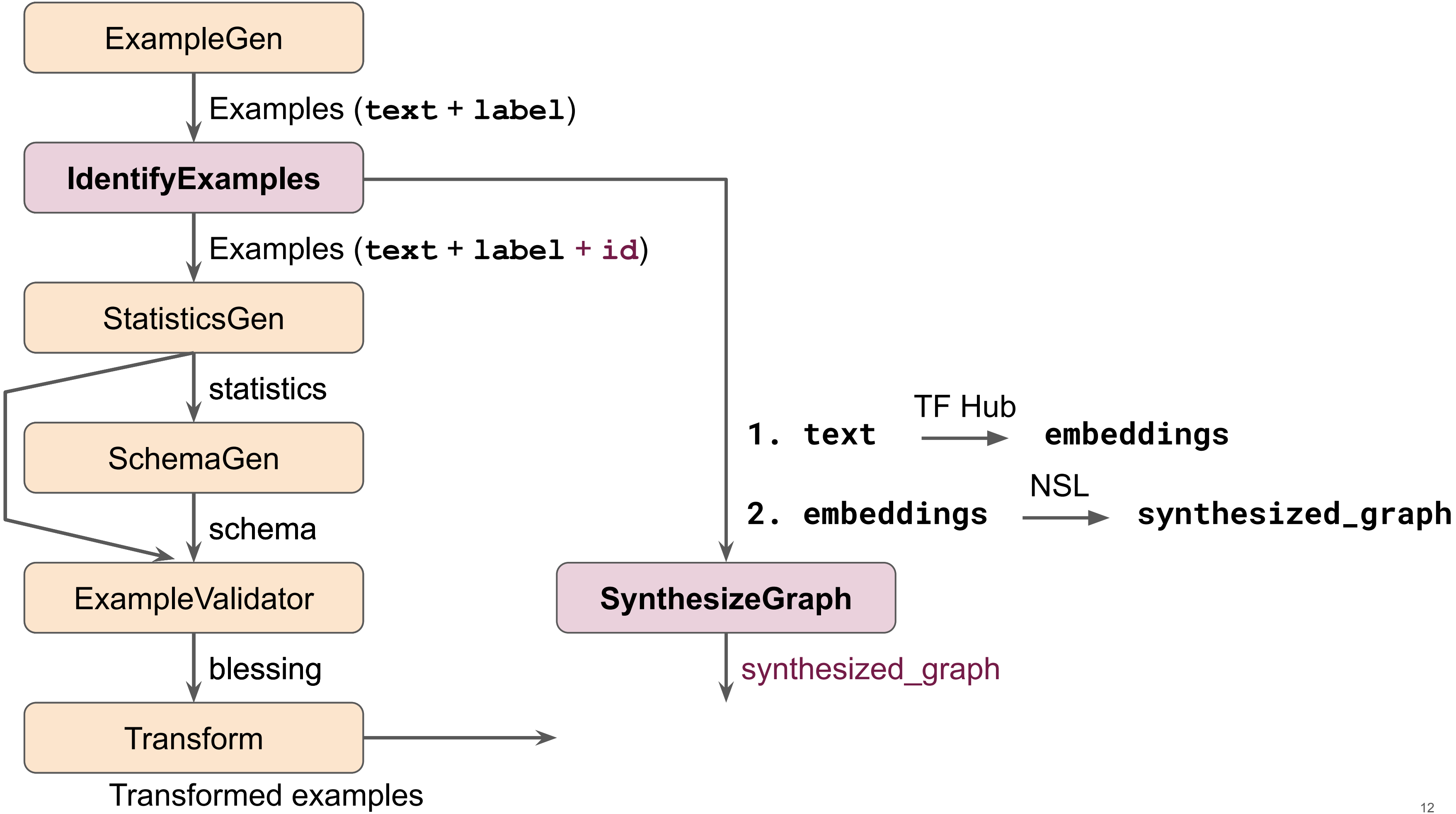
Examples (**`text`** + **`label`**)

IdentifyExamples

Examples (**`text`** + **`label`** + **`id`**)


ExampleGen
Examples (text + label)
IdentifyExamples
Examples (text + label + id)
StatisticsGen
statistics
SchemaGen
schema
ExampleValidator
blessing
Transform
Transformed examples


ExampleGen
Examples (text + label)
IdentifyExamples
Examples (text + label + id)
StatisticsGen
statistics
SchemaGen
schema
ExampleValidator
blessing
Transform
Transformed examples
SynthesizeGraph
synthesized_graph



ExampleGen

Examples (**`text`** + **`label`**)

IdentifyExamples

Examples (**`text`** + **`label`** + **`id`**)

StatisticsGen

statistics

SchemaGen

schema

ExampleValidator

blessing

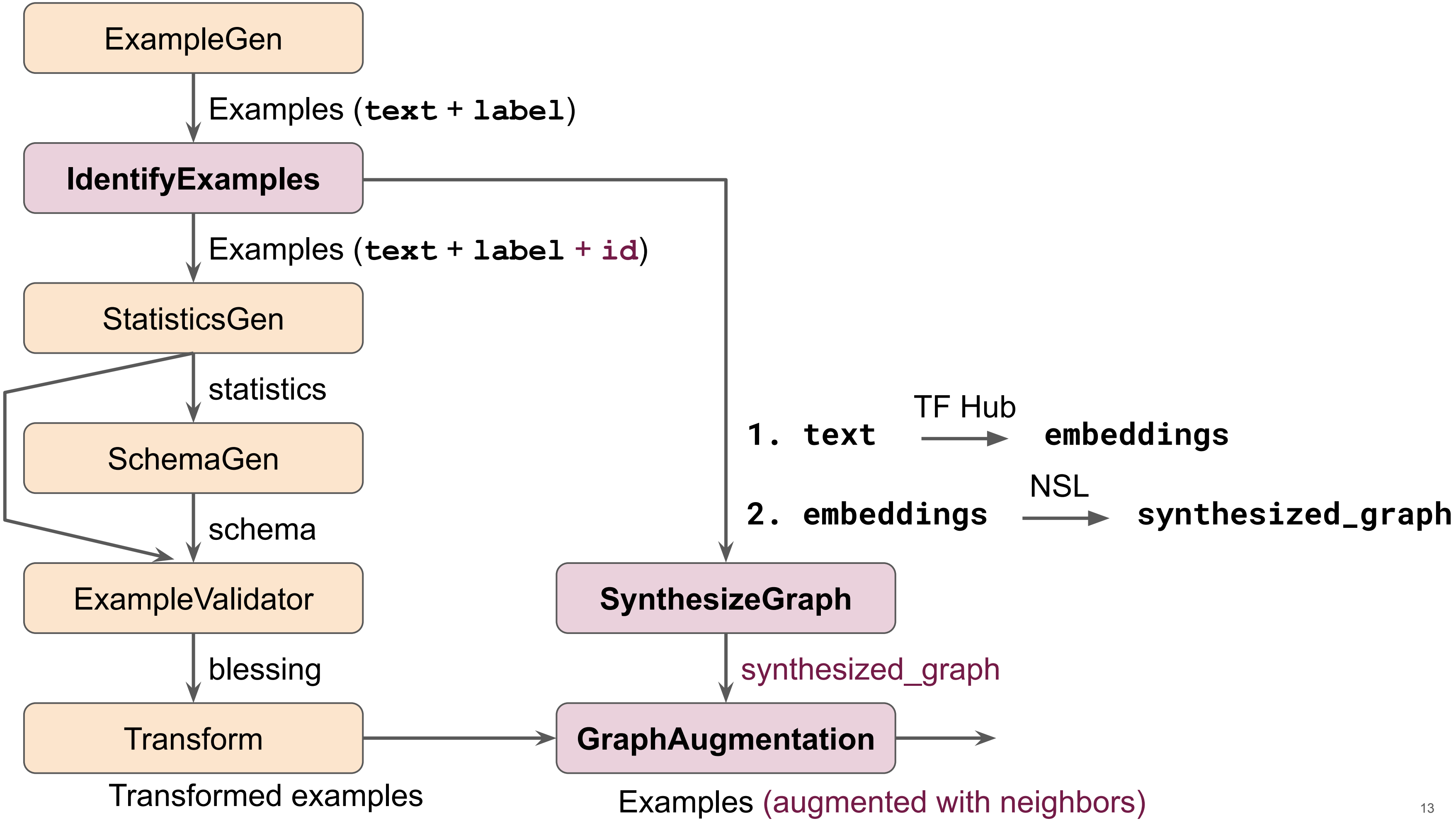
Transform

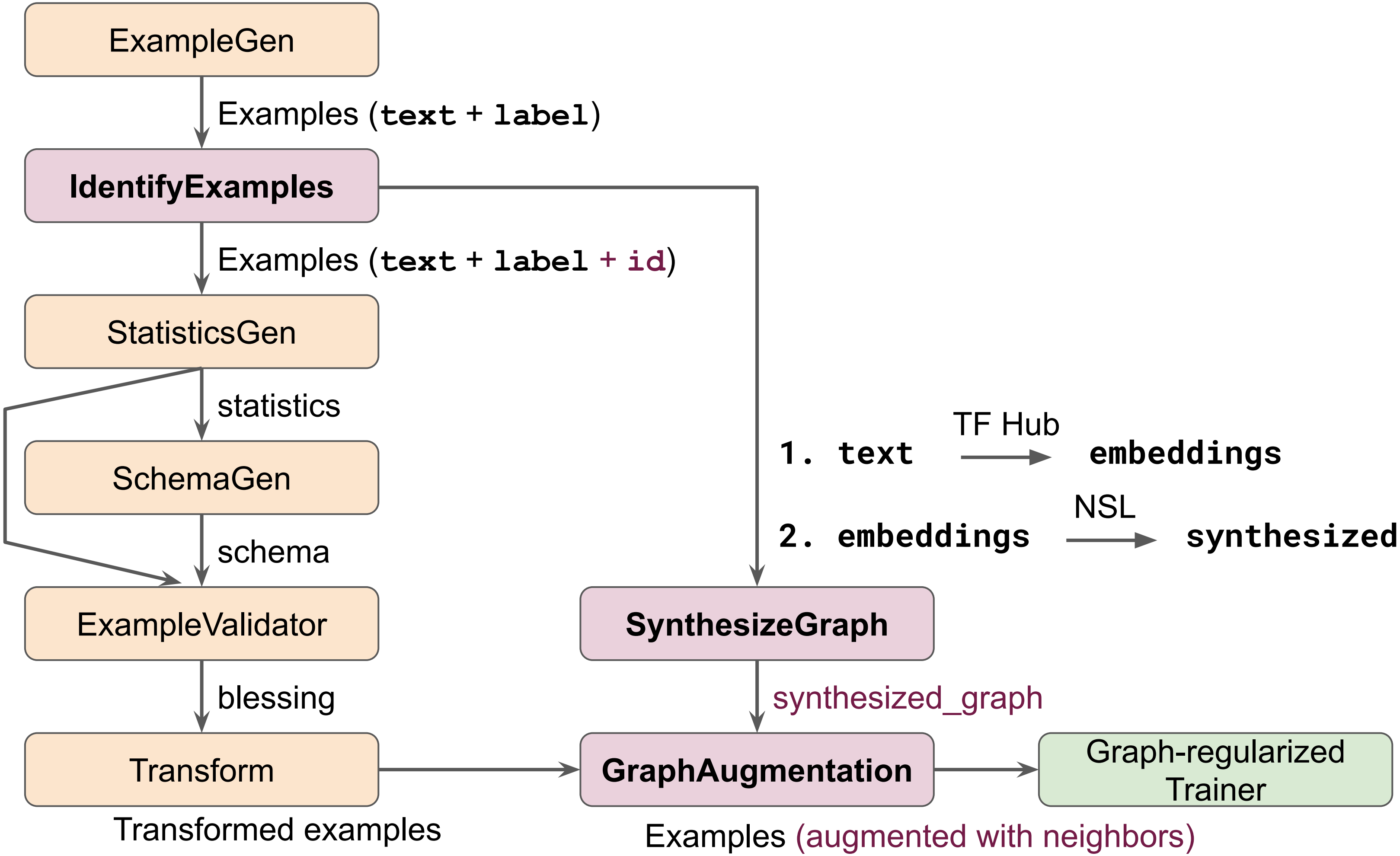
Transformed examples

SynthesizeGraph

synthesized_graph

1. **`text`** $\xrightarrow{\text{TF Hub}}$ **`embeddings`**
2. **`embeddings`** $\xrightarrow{\text{NSL}}$ **`synthesized_graph`**

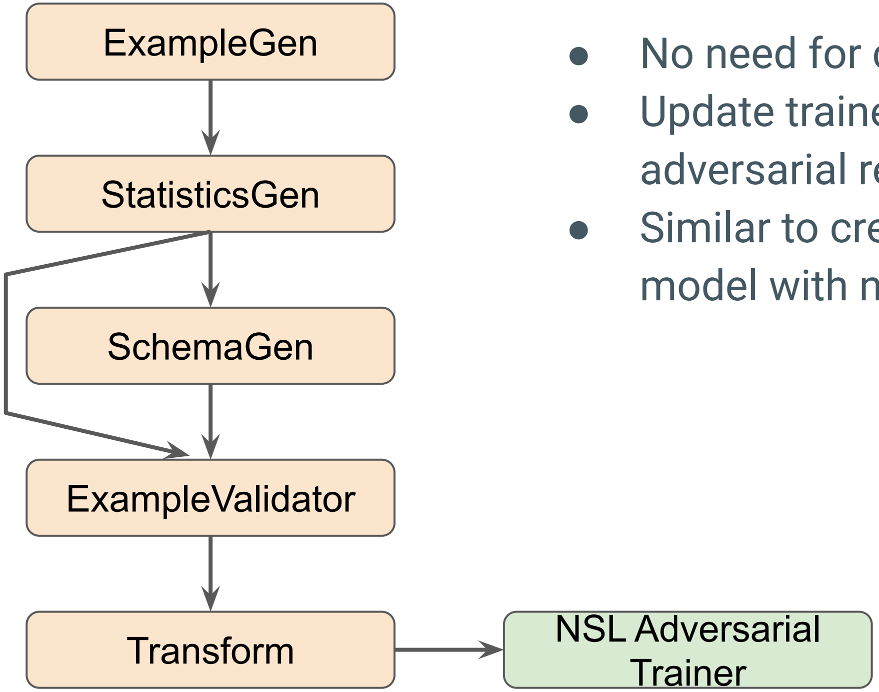

ExampleGen
Examples (text + label)
IdentifyExamples
Examples (text + label + id)
StatisticsGen
statistics
SchemaGen
schema
ExampleValidator
blessing
Transform
Transformed examples
SynthesizeGraph
synthesized_graph
GraphAugmentation
Examples (augmented with neighbors)
1. text
TF Hub
embeddings
2. embeddings
NSL
synthesized_graph



1. text $\xrightarrow{\text{TF Hub}}$ embeddings

2. embeddings $\xrightarrow{\text{NSL}}$ synthesized_graph

Adversarial regularization in TFX



- No need for custom components
- Update trainer component to invoke NSL adversarial regularization APIs
- Similar to creating an adversarially trained NSL model with native TensorFlow