tf.contrib.bayesflow.variational_inference.elbo

```
elbo(
    log_likelihood,
    variational_with_prior=None,
    keep_batch_dim=True,
    form=None,
    name='ELBO'
)
```

Defined in `tensorflow/contrib/bayesflow/python/ops/variational_inference_impl.py`.

See the guide: BayesFlow Variational Inference (contrib) > Ops

Evidence Lower BOund. `log p(x) >= ELBO`.

Optimization objective for inference of hidden variables by variational inference.

This function is meant to be used in conjunction with `StochasticTensor`. The user should build out the inference network, using `StochasticTensor`s as latent variables, and the generative network. `elbo` at minimum needs `p(x|Z)` and assumes that all `StochasticTensor`s upstream of `p(x|Z)` are the variational distributions. Use `register_prior` to register `Distribution` priors for each `StochasticTensor`. Alternatively, pass in `variational_with_prior` specifying all variational distributions and their priors.

Mathematical details:

```
log p(x) =  log \int p(x, Z) dZ
         =  log \int \frac {q(Z)p(x, Z)}{q(Z)} dZ
         =  log E_q[\frac {p(x, Z)}{q(Z)}]
         >= E_q[log \frac {p(x, Z)}{q(Z)}] = L[q; p, x]  # ELBO

L[q; p, x] = E_q[log p(x|Z)p(Z)] - E_q[log q(Z)]
           = E_q[log p(x|Z)p(Z)] + H[q]           (1)
           = E_q[log p(x|Z)] - KL(q || p)         (2)

H - Entropy
KL - Kullback-Leibler divergence
```

See section 2.2 of Stochastic Variational Inference by Hoffman et al. for more, including the ELBO's equivalence to minimizing `KL(q(Z)||p(Z|x))` in the fully Bayesian setting. https://arxiv.org/pdf/1206.7051.pdf.

`form` specifies which form of the ELBO is used. `form=ELBOForms.default` tries, in order of preference: analytic KL, analytic entropy, sampling.

Multiple entries in the `variational_with_prior` dict implies a factorization. e.g. `q(Z) = q(z1)q(z2)q(z3)`.

Args:

- `log_likelihood`: `Tensor` log p(x|Z).
- `variational_with_prior`: dict from `StochasticTensor` q(Z) to `Distribution` p(Z). If `None`, defaults to all `StochasticTensor` objects upstream of `log_likelihood` with priors registered with `register_prior`.
- `keep_batch_dim`: bool. Whether to keep the batch dimension when summing entropy/KL term. When the sample is

per data point, this should be True; otherwise (e.g. in a Bayesian NN), this should be False.

- `form`: ELBOForms constant. Controls how the ELBO is computed. Defaults to ELBOForms.default.
- `name`: name to prefix ops with.

Returns:

`Tensor` ELBO of the same type and shape as `log_likelihood`.

Raises:

- `TypeError`: if variationals in `variational_with_prior` are not `StochasticTensor`s or if priors are not `Distribution`s.
- `TypeError`: if form is not a valid ELBOForms constant.
- `ValueError`: if `variational_with_prior` is None and there are no `StochasticTensor`s upstream of `log_likelihood`.
- `ValueError`: if any variational does not have a prior passed or registered.

Last updated November 2, 2017.