p(s)p(r|s)p(ch|r)p(c|ch) = p(s)p(r|s)p(ch)p(c) = 1/N I[s,r] 1/C 1/W\*H

(Assume I[s,r]=1)

p(s,r,ch,c) = 1/N 1/C 1/W\*H

<tf.Tensor: shape=(32,), dtype=float32, numpy=

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0.1822308 , 0.18693706, 0.18473774, 0.17209728, 0.18293928,

0.18579575, 0.19045556, 0.19045746, 0.19303349, 0.18460274,

0.18310788, 0.18455574, 0.17268884, 0.18440263, 0.18495318,

0.17370763, 0.18361308, 0.20093982, 0.16380447, 0.18290031,

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0.19019651, 0.19062391], dtype=float32)>

mu

<tf.Tensor: shape=(32,), dtype=float32, numpy=

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0.18579558, 0.19045535, 0.19045728, 0.19303328, 0.18460256,

0.1831077 , 0.18455571, 0.17268881, 0.18440259, 0.18495315,

0.1737076 , 0.18361303, 0.20093977, 0.16380443, 0.18290028,

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1.8780065e-05, 1.8780065e-05, 1.8780065e-05],

...,

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1.8780065e-05, 1.8780065e-05, 1.8780065e-05…

joint\_probabilities\_tensor

<tf.Tensor: shape=(125, 32, 32, 32), dtype=float32, numpy=

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...,

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[0.0000000e+00, 0.0000000e+00, 0.0000000e+00, ...,

1.8780049e-05, 1.8780049e-05, 1.8780049e-05…

1/N\*p(r|s)\*1/Ch\*1/WH

p(ch,r) = sum\_s sum\_c p(s)p(r|s)p(ch)p(c) = p(ch) sum\_s sum\_c p(s)p(r|s)p(c)

= p(ch) sum\_s p(s)p(r|s) sum\_c p(c) = p(ch) sum\_s p(s) p(r|s) = 1/Ch sum\_s 1/N p(r|s)

= 1/(Ch\*N) sum\_s p(r|s)

p(s,c|ch,r) = (1/N\*p(r|s)\*1/Ch\*1/WH) / (1/N \* 1/Ch \* sum\_s p(r|s)) = ((1/WH \* p(r|s)) / sum\_s p(r|s))

p(s,c|ch,r) /p(r|s) = {1/WH \* p(r|s)} / {p(r|s) \*sum\_s p(r|s))} = 1 / {W\*H\*sum\_s p(r|s)}

E[x|ch,r] = sum\_s sum\_c x(s,c) \* p(s,c|ch,r)

E[x\_hat|ch,r] = sum\_s sum\_c x(s,c)\*p(r|s)\*p(s,c|ch,r)

E[x|ch,r] = sum\_s sum\_c x(s,c)\*p(r|s)\*{p(s,c|ch,r)/p(r|s)}

When p(r|s) is hard:

E[x|ch,r] = sum\_s sum\_c x(s,c) \* p(s,c|ch,r)

E[x|ch,r] = sum\_s sum\_c x(s,c) \* ((1/WH \* p(r|s)) / sum\_s p(r|s)) = sum\_s sum\_c y(s, c|ch, r)

When p(r|s)=0 then: y(s, c|ch, r)=0

When p(r|s)=1 then: y(s, c|ch, r)=x(s,c) \* ( (1/WH) / sum\_s p(r|s) )

Then E[x|ch,r] = sum\_c sum\_{where p(r|s)=1} x(s,c) \* ( (1/WH) / sum\_s p(r|s) )

E[x\_hat|ch,r] = sum\_s sum\_c x(s,c)\*p(r|s)\*p(s,c|ch,r) = sum\_s sum\_c x(s,c) \* p(r|s) \* ((1/WH \* p(r|s)) / sum\_s p(r|s))

Let y\_hat(s, c|ch, r) = x(s,c) \* p(r|s) \* ((1/WH \* p(r|s)) / sum\_s p(r|s))

When p(r|s)=0 then: y\_hat(s, c|ch, r)=0

When p(r|s)=1 then: y\_hat(s, c|ch, r)=x(s,c) \* ( (1/WH) / sum\_s p(r|s) )

Then E[x\_hat|ch,r] = sum\_c sum\_{where p(r|s)=1} x(s,c) \* ( (1/WH) / sum\_s p(r|s) )

So E[x|ch,r] = E[x\_hat|ch,r] when p(r|s) is hard!!!