Feedback Systems using Non-Binary LDPC Codes with a Limited Number of Transmissions

SP Coding School 2015

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Variable Feedback Coding (VLF): Two Phase

- **Tx**
- **Rx**
- Noiseless feedback
- Coded Confirmation

Diagram:
- Variables: $I_1$, $A_1$, $I_2$, $A_2$, $I_3$, ...
- AWGN channel

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Exhaustive Search (ES) with exponential complexity versus Sequential Differential Approximation (SDA) with linear complexity

Table: Optimized \( \{N_1, N_2, \ldots, N_m\} \), \( R_T \), and \( \lambda \) from ES and SDA for \( k = 96 \) bits for VLFT on a 2 dB SNR binary-input AWGN channel with capacity of 0.642.

<table>
<thead>
<tr>
<th>Alg.</th>
<th>( m )</th>
<th>( {N_1, N_2, \ldots, N_m} )</th>
<th>( R_T )</th>
<th>( \lambda )</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES, SDA</td>
<td>2</td>
<td>158, 188</td>
<td>0.566</td>
<td>169.6</td>
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<tr>
<td>ES</td>
<td>3</td>
<td>150, 167, 194</td>
<td>0.58638</td>
<td>163.71</td>
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<tr>
<td>SDA</td>
<td>3</td>
<td>150, 167, 195</td>
<td>0.58635</td>
<td>163.72</td>
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<tr>
<td>ES</td>
<td>4</td>
<td>146, 158, 172, 198</td>
<td>0.59709</td>
<td>160.77</td>
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<tr>
<td>SDA</td>
<td>4</td>
<td>146, 158, 172, 197</td>
<td>0.59707</td>
<td>160.78</td>
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<td>ES, SDA</td>
<td>5</td>
<td>143, 153, 163, 176, 201</td>
<td>0.603</td>
<td>159.2</td>
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<td>140, 149, 157, 166, 179, 204</td>
<td>0.608</td>
<td>157.9</td>
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<tr>
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<td>7</td>
<td>139, 147, 154, 161, 170, 182, 206</td>
<td>0.611</td>
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</table>
VLFT using NB-LDPC codes achieves about 92% of RCSP throughput for average blocklengths in the range of 150-450 bits.

VLF using NB-LDPC codes with $m = 5$ achieves about 90% of capacity for average blocklengths of 150-450 bits.

This range of blocklengths is interesting:
1. it is still small enough that feedback provides a throughput gain,
2. it is large enough to have practical potential.